

BRICK
ARCHITECTURE
in
Ancient Egypt

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ABBREVIATIONS

I. Literary

- ASAE*
BIFAO
BMMA
 Bresciani, *Medinet Madi*.

BSFE
CdE
CRAIBL
 De Bock, *Materiaux . . . Arch. chrét.*

 Gabra, *Hermopolis Ouest*.

E.M.H.
JARCE
JEA
 Jéquier, G., *Contemporains de Pepi II*.
JNES
L.D.
L.D.T.

 Maragioglio and Rinaldi, *Piramidi Menfite*
MDIK

MDOG
MMAF
 Petrie, *Royal Tombs*.

PM

PMJ
PSBA
Rec. Trav.

RdE
 Ricke, Hughes and Wente, *Beit el-Wali*.

 Ricke and Sauneron, *Elephantine*.

 Tytus, *Palace of Amenhotep III*.

Wb.

ZAS
- Annales du Service des Antiquités de L'Egypte.*
Bulletin de l'Institut français D'Archéologie Orientale.
Bulletin of the Metropolitan Museum of Art, New York.
 Bresciani, E., *Missioni di Scavo à Medinet Madi (Fayum-Egitto).*
Rapporto Preliminare delle Campagne di Scavo 1966 e 1967.
Bulletin de la Société française d'Égyptologie.
Chronique d'Égypte.
Comptes rendus de L'Académie des Inscriptions et Belles Lettres.
 De Bock, W., *Materiaux pour servir à l'archéologie de l'Égypte chrétienne.*
 Gabra, S., *Fouilles de l'Université Fouad el-Awal à Hermopolis Ouest (Touna el-Gebel).*
 Hölscher, U., *The Excavation of Medinet Habu, vols. I-V.*
Journal of the American Research Center in Egypt.
Journal of Egyptian Archaeology.
 Jéquier, G., *Tombeaux de particuliers contemporains de Pepi II.*
Journal of Near Eastern Studies.
 Lepsius, C. R., *Denkmäler aus Aegypten und Aethiopien. Abt. I-VI.*
 Lepsius, C. R., *Denkmäler aus Aegypten und Aethiopien; Text, I-V.* Edited by E. Naville, L. Borchardt and K. Sethe.
 Maragioglio, V. & Rinaldi, C., *L'Architettura delle Piramidi Menfite.*
Mitteilungen des Deutschen Archäologischen Instituts Abteilung Kairo.
Mitteilungen der Deutschen Orient-Gesellschaft.
Mémoires de la Mission Archéologique française au Caire.
 Petrie, W. M. F., *The Royal Tombs of the First Dynasty, I and Royal Tombs of the Earliest Dynasties, II.*
 Porter, B. and Moss, R.L.B., *Topographical Bibliography of Ancient Egyptian Hieroglyphic Texts, Reliefs and Paintings.*
Pennsylvania University Museums Journal.
Proceedings of the Society of Biblical Archaeology.
Recueil de Travaux relatifs à la philologie et à l'archéologie égyptiennes et assyriennes.
Revue d'Égyptologie.
 Ricke, H., Hughes, G.R. and Wente, E.F., *The Beit el-Wali Temple of Ramesses II.*
 Ricke, H. and Sauneron, S., *Die Tempel Nektanebos II in Elephantine und ihre Erweiterungen.*
 Tytus, R. de P., *Preliminary Report on the Re-excavation of the Palace of Amenhotep III at Malqata.*
 Erman, A. and Grapow, H., *Wörterbuch der Ägyptische Sprache, (5 vols.)*
Zeitschrift für Ägyptische Sprache und Altertumskunde.

II. Other Conventions

- | | |
|-------|-------------------------|
| encl. | Enclosure. |
| H | Headers (in charts). |
| M.K. | Middle Kingdom. |
| N.K. | New Kingdom. |
| O.K. | Old Kingdom. |
| S | Stretchers (in charts). |
| T | Temple (in charts). |

PREFACE

The aim of this book is to give a detailed account of the brick architecture of Ancient Egypt and to examine the constructional techniques which were employed to overcome individual architectural problems. The study is divided into three parts: Part One is concerned with a number of general points, and contains chapters on brick manufacture and the early use of brick in Egypt, as well as an explanation of the Corpus of brick bonding systems. In Part Two an account of the surviving brick monuments of Egypt is given, with special reference to technical and structural considerations. This section is divided into chapters dealing with different types of buildings, and the information gathered together provides the basis of the conclusions of this book. The conclusions are stated in Part Three, and largely consist of an examination of the constructional techniques employed at different periods for various purposes, such as the building of walls, floors, foundations and other structures. A discussion of the kinds of brick used, the bonding and the brick sizes is also included.

The information contained in this study has been derived in part from published sources and also from observations made on site. The sources of the published information are stated in the notes; where facts are given without references the details were obtained by personal study in Egypt. The brick buildings of Nubia have, for the most part, been excluded from detailed examination, and are mentioned only in cases where they serve to illuminate the description of Egyptian monuments by providing comparative material. In similar fashion, Coptic architecture is used only briefly to illustrate the later trends in Egyptian brickwork, some features of which are already appearing in Ptolemaic and Roman structures.

For assistance in the preparation of this study I am grateful to Professor H. W. Fairman, Dr. K. A. Kitchen, Mme. F. de Cenival and Dr. B. V. Bothmer. My thanks are also due to the committee of the Egypt Exploration Society, for allowing me to use unpublished material from their excavations, and to Aris and Phillips Ltd., for undertaking the publication of this work in its present form.

INTRODUCTION

Of all the surviving monuments of Ancient Egypt, the most famous are the great stone pyramids of Giza, and the stone-built temples at Luxor, Abydos, Dendera and Edfu. These great works, promoted by the powerful forces of funerary belief or religion, were intended to last for ever, and consequently made use of the most enduring materials with little regard for expense or labour. However, the vast majority of Ancient Egyptian building was constructed more rapidly and economically by the extensive use of sun-dried brick as the major material. A considerable amount of this brick architecture still survives, but it is only a fraction of which must have once existed. Entire cities have disappeared, leaving only the temple standing, a fact which has led to a rather one-sided view of Ancient Egyptian life. Brick buildings in Egypt will last for thousands of years when buried in sand, but once exposed, suffer rapidly from the effects of wind and rain. Blown sand quickly erodes away the soft mud-brick walls, and the occasional rain storms wash the bricks into mud. In addition to this natural decay, the brick buildings in Egypt have suffered greatly from the activities of the *sebbakhin*, who destroy the ruins for the sake of the nitrogenous earth of which they are composed. Even archaeologists, working in the late Nineteenth or early Twentieth century, have tended to treat the excavation of brick buildings with less care than they applied to the stone monuments. For example, the entire town which surrounded the temple of Dendera was cleared away without record, in order to open up the temple, and a similar clearance was made at Edfu, during restoration work on the temple of Horus.¹ Few excavators have thought it worth while to record details of brick bonding, and the brick sizes have been neglected by many.

Fortunately, this lack of work on brick architecture is not universal, and some excellent studies have been made on the subject by certain archaeologists. The most important of these contributions is that of O.H. Myers,² who devised a system of recording the arrangements utilized in the various brick bonds by means of a Corpus, the essential features of which are retained in the revised and extended Corpus of brick bonds given in this study. Some of the older Egyptological publications have attempted to deal extensively with the subject of brick architecture, an example being *L'Art de Batir chez les Egyptiens*, by A. Choisy, which appeared as long ago as 1904. Unfortunately this book, whilst it contains some points of value, includes a fair amount of information which is inaccurate or over-simplified. The tendency to over-simplify and to generalize concerning brick architecture also occurs in other publications, so that it is possible for three separate authorities, drawing the constructional details of the same building, (the brick vaults at the Ramesseum) to produce three entirely different diagrams.³ However, at the present day the position is much improved, and many more excavators are including details of brickwork, in addition to other technical analyses, as a regular feature of their excavation reports. Nevertheless, the reporting could be further improved, and ideally I would like to see the following details of brick buildings recorded as a matter of course, and other aspects of the excavation described to a similar standard:

1. The composition of the bricks, and whether burnt or unburnt.
2. The dimensions of the bricks.
3. The bonding, preferably described by means of a Corpus of bonds.
4. The distribution of any reed-matting or timber tie-beams in the brickwork.
5. The nature of the mortar.
6. Details of any plaster.
7. Whether stamped bricks occur.
8. Any special usages, or bricks of special form.

My own study of the brick architecture of Egypt is intended to consider in detail the technical aspects of brick construction, and matters which do not relate to the structure of the buildings are, in the majority of cases, not included. The individual monuments are described in Chapters 4 to 8, to illustrate the widespread use of brick and the methods used in various types of buildings. These chapters contain a body of information which must form the basis of any work on Egyptian brickwork, comprising the facts which have been recovered from the excavation and study of the surviving monuments. Since this information has, up till now, been scattered in excavation reports and other publications, I feel that it is valuable to assemble it in one place so that the evidence concerning the techniques of Egyptian brickwork is readily available. In the later chapters, the conclusions based on this material are stated, in an examination of the construction of particular architectural features. These conclusions, especially those concerned with brick sizes and bonding, have value in establishing the date to which various structures belong, and it is to be hoped that they will be improved by further work on the subject.

1. Barsanti, A., *ASAE* 8 (1907), 224–232.

2. Mond, R. & Myers, O.H., *The Bucheum*, I, 47–9 & III, Pls. CXII–CXV.

3. L.D., I, 89; Baraize, E., *ASAE* 8 (1907), 198–200; Choisy, A., *L'Art de Batir chez les Egyptiens*, 44–5.

CHAPTER ONE: BRICK MANUFACTURE

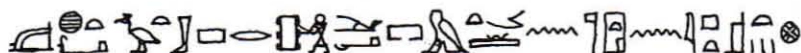
The materials used in making bricks in Ancient Egypt were Nile mud, chopped straw and sand. These were mixed in varying quantities to produce bricks of different characteristics. The commonest type of brick consists of mud and chopped straw with a small addition of sand, but varieties regularly occur which are made up of nothing but sand and gravelly desert soil.

The whole process of brickmaking in Pharaonic Egypt was so similar to that used today that a full description of the stages of production can be given.

Wet Nile mud is mixed with chopped straw and sand, pushed into a wooden mould, and smoothed by hand. The brickmaker then loosens the mould from the brick and lifts it off to leave the wet brick upon the ground. This process is repeated until the whole area is covered with neat rows of bricks, with only the thickness of the frame of the mould between each. The bricks are left to dry for about three days before being turned over, and by the end of a week they are firm enough to be stacked in a heap. The pure Nile mud shrinks by over 30% in drying, but the sand and straw in the bricks prevent the formation of cracks. Experiments with brickmaking in modern times have shown that the best mixture of the constituents is one cubic metre of mud with one-third of that amount of sand, plus 20kg of straw.¹ Bricks containing fine sand, when well dried, can stand compressive stress in the order of 52kg/cm², whereas bricks with the same amount of sand, but also with straw, are less strong.²

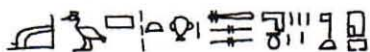
In modern Egypt, the fellahin will occasionally make bricks entirely by hand, dispensing with the wooden mould, and it is quite possible that this method was sometimes employed in Pharaonic times. That the majority of bricks were made in wooden moulds, however, is without doubt, as this method is depicted in ancient representations, and some examples of the moulds have been found.³ These moulds are identical to their modern counterparts, except that they have mortise and tenon joints at the corners instead of nails. From one side a handle projects, by which the brickmaker manipulates the mould. No moulds have yet been found which were intended to produce the specially shaped bricks used for arches, cornices and other distinct architectural features.

Of the evidence from ancient representations about brickmaking, the most valuable comes from the scenes in the tomb of Rekhmire at Thebes.⁴ The process of mixing the mud and making the rows of bricks by the use of wooden moulds is clearly shown, and the inscription accompanying the scene reads:



"Making bricks to build anew the storehouse of the temple of Karnak."

Badawy has argued that *shṭ ḏbt* should mean "to lay bricks" rather than to "make bricks," since the original meaning of *shṭ* is "to weave" or "to plait," which would agree with the Greek use of *πλωθυφος* for the process of bonding bricks into a wall.⁵ However, although the original meaning of *shṭ ḏbt* may have been "to lay bricks," there is ample evidence to show that it also came to mean "to make bricks" from the New Kingdom onwards. This is demonstrated by the example from the tomb of Rekhmire, quoted above, where the scene clearly shows the manufacture, not the laying, of bricks; it is further proved by the frequent scene in foundation ceremonies showing the moulding of the first brick by the King. Since the title of this scene is invariably *shṭ ḏbt*, this can only mean "making bricks" in this context. At Edfu this foundation ritual is accompanied by the inscription:⁶



"Making bricks at the four corners of the temple."

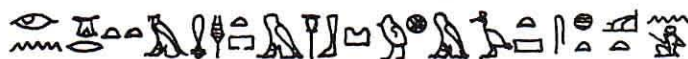
As he holds the brick-mould, the King says to Horus:



"I make a brick in order to build your sanctuary."⁷

1. Fathy, H., *Gurna: A Tale of Two Villages*, 252.
2. *ibid.*, 287-8. On the use of straw see Caminos, R., *Late Egyptian Miscellanies*, 190.
3. Petrie, W.M.F., *Tools and Weapons*, Pl. XLVII, 55.
4. Davies, N. de G., *The Tomb of Rekhmire at Thebes*, Pl. LVIII.
5. Badawy, A., *ASAE* 54 (1957), 51ff., especially p.64.
6. Chassinat, E., *Edfu*, II, 60.
7. *ibid.*, 61, & vol. XII, Pl. CCCLXXII.

Since the King is actually holding the brick-mould, it cannot be said that he is "laying bricks," as Badawy argues. He gives an example of the earlier meaning of *shṭ* from a Middle Kingdom stela, but either translation of the word could be read:

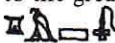


"Now I made this tomb in Abydos, of brick which I assembled." ⁸

Another Egyptian word used in relation to brickwork is  (*pīp*), ⁹ "to make (bricks)," which becomes the Coptic *πωωπε*. Badawy also quotes a phrase from the Edfu texts referring to the preparation of mud for bricks:



"I mix earth with water." ¹⁰

A papyrus of the Nineteenth Dynasty ¹¹ contains accounts of brickmaking and records the number of bricks produced by various workmen, but unfortunately does not state the length of time required to make the bricks. In modern Egypt, a team of four brickmakers will produce an average of 3,000 bricks per day, but the rate of manufacture in ancient times may have been slightly less, owing to the greater size and weight of many of the bricks. The same papyrus contains an otherwise unknown word  taken in the *Wörterbuch* to mean "to burn bricks." ¹² This is possible, since burnt bricks were used in Ramesside buildings in special circumstances, ¹³ but the damaged state of the text makes it impossible to be sure of the meaning of the word. References to brick manufacture in other texts are similarly lacking in precise details; Papyrus Reisner I apparently records the production of 65 cubic cubits of bricks per day, ¹⁴ and contains several words for "brick-clay" and related materials. ¹⁵ A demotic text, Papyrus Sorbonne 276, ¹⁶ refers to the use of old bricks for the rebuilding of a storehouse, showing that the re-use of bricks was a common practice.

8. Lange, H.O. & Schäfer, H., *Grab und Denksteine des M.R.*, 20733.

9. *Anastasi V*, 3,1.

10. Badawy, A., *ASAE* 54 (1957), 57.

11. Virey, P., *Parchemin Rapporté de Thebes*, in *MMAF*, 1, 481-510.

12. *Wb.*, V, 156, 7.

13. See below, pp. 44, 140.

14. Simpson, W.K., *Papyrus Reisner I*, 62.

15. These words discussed by Simpson, *op. cit.*, 72, 75-7.

16. I am grateful to Mme. F. de Cenival for details of this text.

CHAPTER TWO: THE EARLIEST USE OF BRICK IN EGYPT

It is difficult to establish precisely when the use of brick for building began in Egypt. The earliest buildings of any size are the First Dynasty mastabas of Saqqara and Naqada, and the tombs of Abydos. In these structures, and especially in the Saqqara mastabas, we see a highly-developed architecture making expert use of the building materials. Previous to the First Dynasty, however, very little has been discovered to illustrate the earlier efforts of the Egyptians in brick building, and the remains which have been found are not on any sizeable scale. The sophisticated architecture of the Archaic Period seems, like so many things at this point in Egyptian history, to appear suddenly, fully formed. Whilst there can be no doubt that influences from Mesopotamia helped to promote this new outburst of building in the early dynasties, there is also evidence to show that the inhabitants of the Nile Valley during the Naqada II period were not unfamiliar with the large-scale use of brick as a building material. This evidence comes mainly from the slate palettes, ivory labels and mud-sealings of the age.

On the fragmentary Tjehenu palette in Cairo, a series of walled enclosures or towns are shown, in the process of being attacked by animals representing different provinces. Such buttressed defensive walls could only have been constructed of brick, and must have been of sufficient height and thickness to resist attack. Another example occurs on the Narmer palette, where the King, in the form of a bull, has broken into one of these walled towns. The mud-sealings from the Abydos First Dynasty tombs frequently show oval enclosures of this type. Some sealings¹ show a more developed enclosed town or camp, where the surrounding wall is laid out on a rectangular plan in the form of the hieroglyph  *hwt*, which represents a walled area with a gateway at one corner.² There is great similarity between the enclosures represented on the sealings and the "Funerary Palaces" of Abydos, the surviving examples of which date from the Second Dynasty. It seems likely, therefore, that at the time of the unification of Egypt there were in existence settlements protected by fortified brick walls, probably of comparable size to the Shunet ez-Zebib at Abydos, whose wall is now 11m high and 5.30m thick. If constructions of this size were present to have been attacked by Narmer, then they must also have existed during the latter part of the Naqada II culture, although no remains have as yet been found.

The only town site to have yielded remains of the brickwork of Predynastic times is Naqada, where Petrie discovered a town of the Naqada I – II periods. The buildings were constructed of bricks measuring 29 x 11.5 x 7.5cm, and "showed carelessness about squareness and angles."³ Unfortunately no specific architectural details are available about this Naqada town, but Petrie's description indicates that the ruins were of considerable extent.

At other Predynastic settlement sites no definite examples of the use of brick have been discovered, except for some special bricks used in the construction of kilns for roasting grain. These bricks take the form of long thin bars of baked clay, and their use implies that the Predynastic Egyptians were aware of the process of baking bricks, although they never employed it outside this context. Grain kilns of this period have been found at Abydos and Mahasna; those at the latter site employ burnt bricks up to 71cm in length.⁴

The surviving funerary monuments of the Predynastic period make infrequent use of brickwork. Most tombs with brick-lined pits which were once thought to belong to the Naqada II period have been assigned, on the revision of Petrie's Sequence Dating, to the First Dynasty. The earliest bricked tombs appear to be those of Cemetery T at Naqada,⁵ dated to S.D. 50–70, together with the Decorated Tomb at Hierakonpolis,⁶ which, it has recently been shown,⁷ belongs to the same architectural type as these Naqada graves. The Decorated Tomb has been dated to S.D. 63,⁸ therefore placing it very close to the time of the unification of Egypt by Narmer, whilst the Cemetery T at Naqada would seem to be of Naqada II date,⁹ but very likely running over into the early First Dynasty. Brick is employed in these tombs for lining the walls, and also in some cases for the construction of a short internal cross-wall, which divides the pit into two rooms. Details of this brickwork are non-existent, except for the fact that the walls were apparently about 50cm thick with plaster-coated surfaces. There is doubt as to the nature of the roofing of the tombs: F.W.Green first thought that the Decorated tomb had been vaulted, but later revised his opinion and categorically stated that the roof had been

1. Petrie, W.M.F., *Royal Tombs*, I, Pl. XXVI, 58–60, and II, Pl. XI, 1.

2. Gardiner, A.H., *Egyptian Grammar*, 493, 6.

3. Petrie, W.M.F., *Naqada and Ballas*, 54.

4. Garstang, J., *Mahasna and Beit Khallaf*, 7.

5. Petrie, *Naqada and Ballas*, 18 ff.

6. Quibell, J.E. and Green, F.W., *Hierakonpolis*, II, 20–1.

7. Kemp, B.J., *JEA.*, 59 (1973), 36–43.

8. Payne, J.C., *JEA.*, 59 (1973), 31.

9. Kemp, *op. cit.*, 42.

of wood.¹⁰ One of the tombs at Naqada, numbered T.15, is said to have consisted of a vaulted chamber built in a pit,¹¹ but, as B.J. Kemp has pointed out,¹² this statement has to be treated with caution, specially since no mention is made of vaulting in Petrie's field notebook. The only other interesting point concerning the brickwork of these tombs is the possible use of a brick arch above a doorway in T.23, although the evidence for this relies on a scribbled note in the original excavation records.¹³ If an arch did exist, it would probably only have been a rough corbel or gabled structure of two or three bricks, since the span of the doorway was only 60cm. I think it unlikely that the true arch or proper vaulting would have been used in this cemetery, when we have only a single instance of the use of true vaulting from the more developed monuments of the First Dynasty, and no example of the arch until the Third Dynasty.

The architecture of these tombs shows that brick was in use for funerary monuments in the late Naqada II period, and must have been used for some time previously, since the brickwork is not unaccomplished and the builders evidently were familiar with the material. At a slightly later date, in the early First Dynasty, brick lining is common in tombs at Naqada, and occurs also at Mahasna, El-Amra, Tarkhan and elsewhere.

The origin of Egyptian brick architecture seems to lie in the main settlements of the later Predynastic period. This would explain how it is possible for an extensive use of brick to appear at Naqada, this being an important town, whilst no brickwork occurs in the less urbanized communities of Mahasna or Badari, where the emphasis was apparently on wattle-and-daub construction.¹⁴ Probably further excavation at important Predynastic sites such as Hierakonpolis and Koptos would shed more light on the early brick architecture of Egypt, and its relation to the fortified towns shown on the palettes and sealings. Certainly, at the time of the unification of the country by Narmer, the art of building in brick was well understood, ready to develop under the influence of Mesopotamia to produce the magnificent panelled monuments of the Saqqara archaic cemetery.

10. *ibid.*, 38.

11. Petrie, *Naqada and Ballas*, 24.

12. Kemp, *op. cit.*, 41.

13. *ibid.*, 41.

14. Garstang, J., *Mahasna and Beit Khallaf*, 6.

CHAPTER THREE: THE BONDING CORPUS

The only attempt to standardize the description and recording of the various types of brick bonding used in Egyptian architecture was made by O.H. Myers in his publication of the *Bucheum*¹ and continued in his other excavation reports. As Myers himself remarked, the formation of such a Corpus makes for a great saving in time over written descriptions of bonds, and it is a great pity that no-one has bothered to utilize his system in later works. This Corpus, although basically sound, suffers from a number of inconsistencies and consequently requires some modification. The new system which I am about to describe was devised to eliminate the difficulties whilst preserving the same underlying principles as used by Myers.

When a bond is described in the old Corpus, three facts are embodied in the code given to that bond. The first, indicated by a letter, is the type of structure under examination — W for wall, C for corner, A for arch, and etc. This is followed by a number which indicates the thickness of the brickwork, on the principle that 1.0 = one brick-length, 1.5 = one brick-length plus one brick-width, and so on. Finally comes a small letter, which is the type letter for the arrangement of brickwork under consideration. For example, bonds with alternate courses of headers and stretchers are given the letter *a*, whilst those with layers of edger-headers are labelled *c*. Minor variations on the same general arrangement are indicated by numbers after the letters, e.g. W1.5a1. This rather complex description can be simplified by dispensing with the first two parts of the coding, since in most cases these are not absolutely necessary. It does not really matter to which structure the brickwork belongs when it is the bonding which is being recorded. Nor is it always necessary to record the thickness of many structures, especially walls, since the bonding is, in most cases, the same all through. It is only of real value to state the wall thickness in this way when it is of special interest or directly affects the bond being used.

The result of all this is the formation of a new Corpus using a coding comprised of a letter and a number only, the general arrangement being indicated by the letter and minor variations by the number. It can be seen from the drawings that all the bonds included under one letter have the same characteristics: Type A denotes a face bonding which shows courses of headers and stretchers (not necessarily in alternate layers), Type B has headers and stretchers mixed in the same course, Type C always employs edger-headers, and so on for the other types.

One of the main defects of the old Corpus was its inability to deal with bonds which impart a different appearance to the opposite faces of the same wall. For example, by drawing the section of bond W1.5d, it can be shown that the reverse face of any wall of this type would have a face bond of two courses of stretchers alternating with one course of headers, an arrangement which is given in the same Corpus² as W1.5c. The same confusion applies to bond W1.5a1 which gives an appearance to the reverse side of the wall of W1.5c. This weakness of the old system was one of the main reasons for modifying it. In the new Corpus, these complex bonds are classified by giving the relevant code letter for each face of the wall, and writing them together. Thus the code AC describes an arrangement in which one face of the wall has the characteristic appearance of a class A bond, whilst the other face conforms to type C.

The classification of arches and vaults by Myers is rather unsatisfactory.³ In my own Corpus, the bonding of these structures is recorded using small letters to distinguish them from the capitals used for other brickwork. The same principles of typing are used, the letters indicating the arrangements, but the use of a,b,c, etc. must not be taken as having any relation with the bonds labelled A, B, C..., which do not refer to arches or vaults. Arches consisting of several rings of brick, of different arrangements, have two letters to show the bonding of the various rings. In these cases, the first letter of the code applies to the upper rings of brickwork, and the subsequent letter to the inner courses.⁴

Throughout this study bonds are referred to by their numbers in the Corpus, to avoid repetitive lengthy descriptions. In some cases the thickness of the wall is stated in terms of brick-lengths immediately after the code for the bonding, e.g. A2(1.5). This system is particularly useful for arches and vaults, where it is more important to record the number of courses employed. Occasionally I state the thicknesses of structures by this method separately from the bonding; in these cases, for example, "a wall with a thickness of 2.5," means a wall whose width is equal to two and a half brick-lengths. It should be noted that the drawings all show the simplest known versions of each bond, because a wall bonded in (for example) A3 may be anything from two to twenty brick-lengths across, but since the bonding pattern is unaffected, only the basic bond is drawn. The drawings of all the bonds so far typed are given on Plates 1–20.

1. Mond, R. and Myers, O.H., *The Bucheum*, I, 47–9, and III, Pls. CXII–CXV.
2. Mond, R. and Myers, O.H., *The Bucheum*, III, Pl. CXII.

3. *ibid.*, Pls. CXIII–CXIV.
4. See Corpus drawings of bonds cx1 and cd1.

CHAPTER FOUR: FUNERARY ARCHITECTURE

1. Early Pit-Tombs.

The earliest tombs to make use of brick have been discussed above, (p.5) these being those of Cemetery T at Naqada and the Decorated Tomb of Hierakonpolis. These monuments are followed, in the First Dynasty, by a large number of tombs at Naqada, Tarkhan, Mahasna and elsewhere, which use brickwork for the lining of the pit. In small private graves these lining-walls are usually half to one brick-length in thickness, and are commonly mud-plastered on their interior faces. The simplest tombs of this type have a single chamber in the substructure and were originally roofed with wooden beams and planks. No brick superstructures have yet been found above lined pits of this kind, although simple brick mastabas were discovered by Petrie over unlined pit-graves of the First Dynasty at Tarkhan.¹ The construction of the lining of the graves differs little from one site to another. Where the brickwork is only a half-brick in thickness, the bonding has of necessity to be X1. Examples of this type are found in grave 1006 at Tarkhan,² 1643 and 1525 at Naga ed-Der³ and 20.i.1 at Tura,⁴ but very many more examples occur at these and other sites. Other graves have a lining double this thickness, and although in some cases the brickwork is still composed only of stretchers, the majority show more attempt at bonding. At most cemetery-sites of this type the bond used is A1, i.e. alternate courses of headers and stretchers, but at El-Amra and Naga ed-Der A8 was most frequent. The alternation of three courses of stretchers with one of headers seems to have been particularly prevalent at the latter site, so much so that for thicker walls the rare bonds A5 and A7 are utilized, in contrast to the A2 or A3 adopted at all other sites. In the majority of cases the bricks were mortared roughly with mud and plastered over, but at Naga ed-Der Reisner records that no mortar was used, and the brickwork relied solely on the mud-plaster for cohesion.⁵ This mud-plaster is usually from one to three centimetres in thickness.

Further examples of small brick-lined tombs are found in the subsidiary graves which cluster around the large funerary monuments of Abydos, Giza and Saqqara. Few structural details of the brickwork are available for the first two sites named: it is only possible to say that all the Abydos subsidiary graves, and those of Giza mastaba V, were lined with brick and roofed with wooden planks. Much more information is recorded from the satellite burials of the First Dynasty tombs at Saqqara, which will now be considered:

The individual graves around Saqqara tomb 3503⁶ are lined with brickwork, bonded X1(0.5), and plastered internally. (Fig.1) The roofing is formed of two logs, laid longitudinally over the pit, with planks across them above. Some of the graves had one course of brick laid over the wooden roof, a feature which sometimes occurs in this type of tomb in the provincial cemeteries, examples being found at Naga ed-Der, El-Amra and El-Ahaiwa.⁷

In the reign of Uadji the subsidiaries of Tomb 3504 were constructed by digging a trench and dividing it up by cross-walls to form rows of small graves.⁸ This technique is also used at Abydos and (in part) around Giza mastaba V. The bonding employed in the lining and cross-walls of Uadji's satellite graves is unfortunately not recorded, but it is known that the lining-walls were one brick-length thick and coated with mud plaster. The graves were roofed with planks and reeds, above which stood superstructures built of brick and filled with rubble. As can be seen in the drawing (Fig.2), the sides of these small mastabas are bonded A1 and the roof consists of a slightly vaulted layer of stretchers. This vault is not self-supporting, however, as it rests directly on the internal filling, a feature which also occurs in grave 2039 at Tarkhan.⁹

Subsidiary graves around tomb 3506¹⁰ also possessed low superstructures, but in this case they were constructed of mud. The substructures were lined with brick, bonded A1(1.0), and some had a course of brick above the wooden roof.

The most interesting of all the satellite burials at Saqqara are those around a large tomb dated to the reign of Ka-a. (3500)¹¹ Unlike the graves discussed above, these do not have a brick lining to the pit, but they have the best-preserved brick superstructures of any graves of their type so far discovered, and these superstructures show an advance in architectural technique. The usual wooden roofing used in all other examples of subsidiary graves of the First Dynasty is here replaced by an inclined vault, built against the enclosure wall of tomb 3500. This vault, the earliest certain example known, corresponds to type d1 of the Corpus. Above the vault a small mastaba was built, also of brick. The brick casing of this

1. Petrie, W.M.F., *Tarkhan II*, Pls. XII-XIV

2. Petrie, W.M.F., *Tarkhan I and Memphis V*, 8.

3. Reisner, G.A., *Naga ed-Der*, I, 20-1.

4. Junker, H., *Friedhof in Turah*, 16.

5. Reisner, *op cit*, 27.

6. Emery, W.B., *Great Tombs of the First Dynasty*, II, 143-158.

7. Reisner, G.A., *Tomb Development*, 17.

8. Emery, *op. cit.*, 12-3.

9. Petrie, W.M.F., *Tarkhan II*, Pl. XVI

10. Emery, W.B., *Great Tombs of the First Dynasty*, III, 46-9, Pls. 45-9.

11. *ibid.*, 102 and Pls. 116, 120.

Fig.1 Cross-section of subsidiary grave of Tomb 3503 at Saqqara.

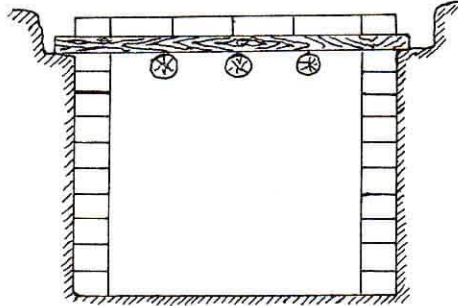
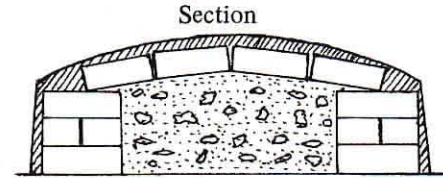


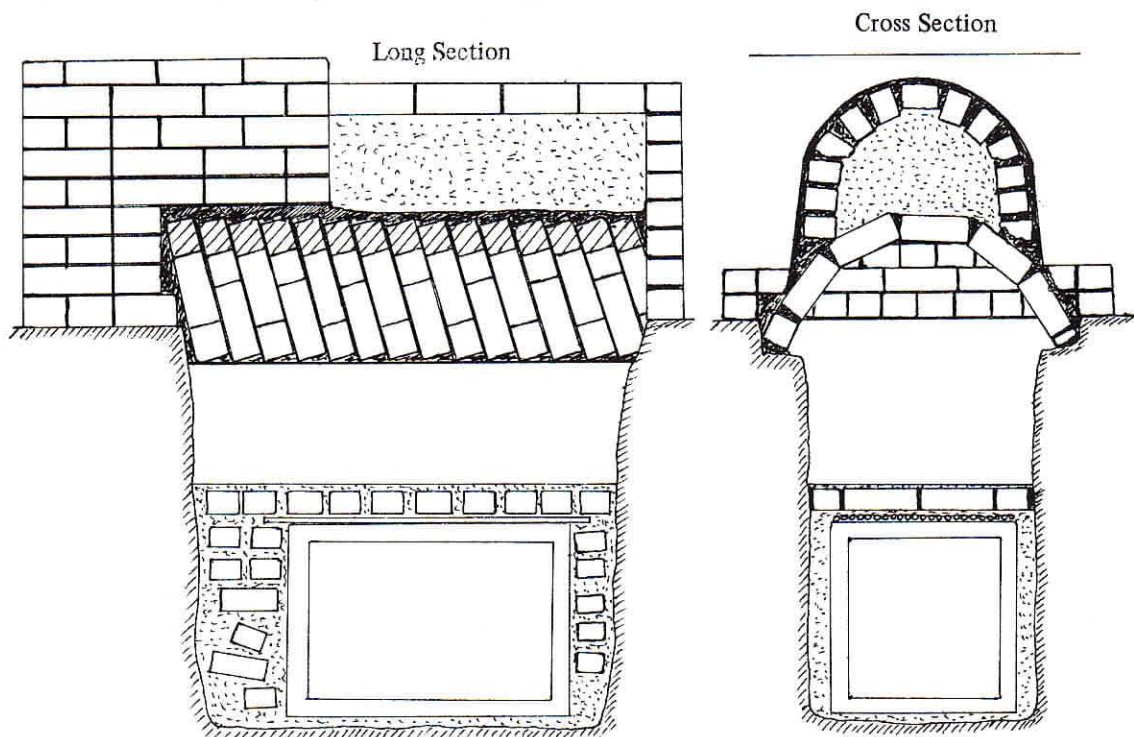
Fig.2 Superstructure of subsidiary grave of Tomb 3504 at Saqqara.



mastaba stands on a low pedestal, and is only half a brick in thickness, therefore consisting entirely of stretchers. At the top of the mastaba, which is of a vaulted shape, the bricks rest on the sand filling. (See Fig.3) These important graves show that the inclined vault was known by the late First Dynasty and was in use in the Memphite area to cover short spans. It seems probable that in Upper Egypt the vault was not introduced until much later.

The use of brickwork in tombs was extended during the First Dynasty to include cross-walls in the substructure, thereby dividing the pit into a number of compartments. An early example of this is seen in the 'Decorated Tomb' at Hierakonpolis,¹² discussed above, which is divided into two parts by a short wall built out from one side of the chamber. At a slightly later date, the substructure is split into two, three or five compartments according to the plans given in Fig.4(p.12) These types have been found at El-Amra,¹³ Naga ed-Der,¹⁴ and Tura.¹⁵ The cross-walls are generally found to be thinner than the lining of the pit, and the two seem never to be interbonded. Instead, the lining was constructed first and then the thin

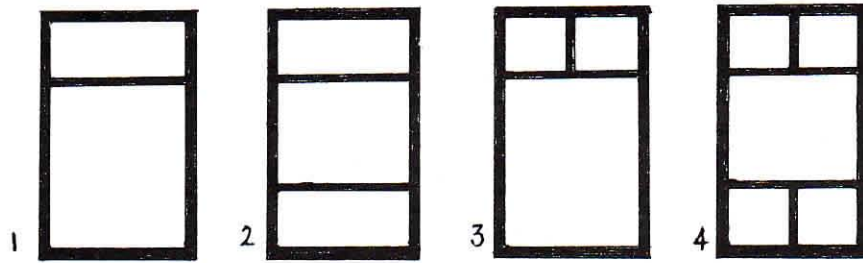
Fig.3 Subsidiary Grave of Tomb 3500 at Saqqara



internal walls were added, merely butting up against the sides of the pit. Most often all the brickwork is coated with mud-plaster which helps to consolidate the unbonded corners.

12. Quibell, J.E. and Green, F.W., *Hierakonpolis II*, Pl. LXVII
13. McIver, D.R. and Mace, A.C., *El-Amrah and Abydos*, Pl. IV
14. Reisner, G.A. *Naga ed-Der*, I, 27ff.
15. Junker, H., *Friedhof in Tura*, 18-20.

Fig.4 Cross-Walls in Small Graves.



The thinness of the cross-walls results from their being built entirely of stretchers, although in some of the larger tombs at Naga ed-Der¹⁶ the walls reached a thickness of 1.0 and were bonded A8. These examples are more advanced than the simple brick-lined pit in that they have stairway entrances from one side, a roof of wood and brick, and were originally covered by a niched mastaba superstructure.

2. Corbel-roofed tombs of the Second Dynasty.

Although we still have to examine the tombs of the First Dynasty at Abydos and the panelled mastabas of the same period at other sites, I have included here a description of certain Second Dynasty tombs since they are a direct development of the early wood-roofed graves discussed in the previous section. The substructures of the corbelled tombs are still built in the same fashion as those of the simple First Dynasty graves, with three or five rooms, the latter being more frequent. Stairway entrances descend into the pit from the side and are flanked by the thin retaining walls of brick. The wooden roofing of the earlier graves is replaced by a roof formed of corbelling in brickwork to form a false vault. Usually a separate corbel stands above each room of the substructure and the brickwork is built up over the tomb into a solid mass. On evidence recovered from tomb N.1514 at Naga ed-Der,¹⁷ the superstructures over the corbelled burial chambers are shown to have been brick mastabas with simplified palace-facade panelling, enclosed within a brick wall. Some tombs of this type have been found at El-Amra¹⁸ but no diagrams of the brick construction are available from this site. By far the greatest number of corbelled tombs, however, occur at Naga ed-Der, where the constructional details were so completely recorded that the best preserved examples can be described individually.

N.1584.¹⁹

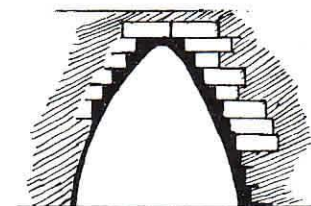
Three chambers of the pit of this tomb are roofed with separate corbel-vaults, the inner faces of which have the appearance of A1 bonding, but behind the face the bricks are all laid as headers. Each course of the vault projects approximately 3–4cm beyond the course immediately below, and the roof is joined at a height of 1.35 metres. The corners of the corbels are made rounded by laying the bricks in a radial plan, and all the walls are coated with mud-plaster. The stairway entrance to this tomb has flanking walls of stretchers (bonding X1(0.5) and the doorway into the substructure is roofed with wooden beams, upon which the corbelling rests. A course of bricks on edge is included in one of the cross-walls of the pit with the purpose of compensating for differences in the level of the ground.

N.1586.²⁰

Five individual corbel vaults, which merge into a mass of brickwork above, cover the five chambers of the substructure. The vaults, which are plastered internally, have groined corners unlike those of tomb N.1584. Examples of groined vaults occur also in tombs N.1511, 1513 and 1626. The internal face of the corbel shows three layers of stretchers alternating with one of headers, but the solid mass of the structure is composed, as usual, of headers only. Above the entrance the bricks rest on the wooden roofing of the door at the base of the stairway.

There are several tombs of similar size and structure to the two described above, but in none is the brickwork so well preserved. Some details of their construction are given in the table on page 15. Further examples of the use of corbel roofing are found in the smaller tombs of the Second Dynasty at Naga ed-

Fig.5 Section of Vault Tomb N.1586



16. Reisner, *op. cit.*, 34-5. Examples are Tombs 1608, 1621 & 1624.

17. Reisner, G.A., *Naga ed Der*, I, 45.

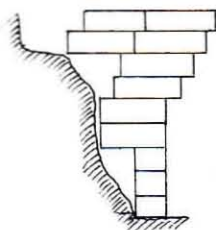
18. McIver, D.R. and Mace, A.C., *El-Amrah and Abydos*, 34.

19. Reisner, *op. cit.*, 52-3 and Pls. 29-30.

20. *ibid.*, 41-2 and Pls. 32-3.

Der. These are stairway tombs with usually only a single chamber in the substructure. Most of these graves have groined vaults, only N.1619 and 1622 showing the radiating of the bricks used to produce rounded corners.²¹ The corbelling usually begins at the third or fourth course of the walls of the pit, and quite often these walls show thickening at this point to provide a firm base for the brickwork above. (See Fig.6) The bonding of the face of the vaults is rather irregular

Fig.6 Base of corbel to show thickening of walls.



in these small graves, but the backing is invariably built of headers. Mud plaster is used on all the brickwork. Two tombs from Cemetery N.3000 are the best preserved examples of this group. Their constructional details are as follows:

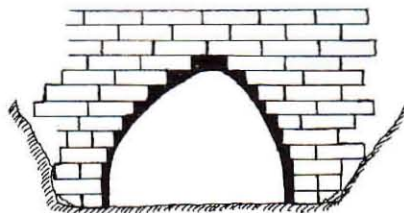
N.3014.²²

The roofing consists of a groined corbel made up entirely of headers, which bond irregularly at the angles. The vault springs from the third course of the substructure walls and covers a span of 0.95 metres. In the burial chamber the cross-walls are bonded neither with the main walls nor with each other, but great quantities of mud-plaster have been spread over the joints.

N.3022.²³

This tomb is constructed with bricks measuring 24 x 12 x 6cm, largely unmortared, but covered with plaster. The West side of the corbel has headers on the face, whereas the East side alternates headers and stretchers for five out of its seven courses. This has caused the West side to have a greater degree of curvature than the East, making the junction of the two sides markedly off-centre. (See Fig.7, below) Internally, the vault is plastered and groined, but in the thickness of the brickwork the corner bonding is very irregular.

Fig.7 Section of corbel, tomb 3022 at Naga ed-Der.



The use of the corbel-vault to cover the substructure of these tombs represents an advance over the earlier wooden roofing, but shows a probable ignorance of true vaulting in Upper Egypt at this date. A disadvantage of the system is that a large amount of brickwork has to be constructed behind the face of the vault as a cantilever to the weight of the overlapped courses. The bricks used at Naga ed-Der averaged 28 x 14 x 7cm. Corbelling in brick seems to be restricted to Upper Egypt in the Second Dynasty, practically all the examples coming from Naga ed-Der and El-Amra. Tombs 518 and 669 at Qau were apparently also corbelled, but no details of the construction of these tombs are given.²⁴ The corbel-vault recurs later in small graves of the Fourth and Fifth Dynasties, but without the entrance stairway present in the earlier type. (See below, p.29)

3. Abydos Cemetery B and the Archaic Tombs of Umm el-Qa'ab.

The tombs of Cemetery B at Abydos are dated to the early First Dynasty, and are a larger version of the brick-lined pit-grave discussed above in Section 1. Unfortunately, very little information has been published about the brickwork of these tombs, although the lining-walls of the pits were of considerable thickness. Apart from the fact that the walls were plastered with mud, the only other details available are the sizes of the bricks in tombs B.15 and B.19. These are given in the table on page 14. The roofing of the tombs was made of wood, in some cases supported at intervals by upright posts.

There is rather more information available about the construction of the large royal tombs or cenotaphs at Abydos. Petrie gives a list of the brick sizes for the various tombs,²⁵ and the measurements are stated in the summary on page 14. Further details of the brick construction can only be obtained from the photographs published by Petrie in *Royal Tombs of the Earliest Dynasties*, volumes I and II. The tombs take the form of a brick-lined substructure divided into several rooms, the roofing, and, in many cases, the burial chamber, being made of wood. Reisner's theory that certain of the tombs were roofed with brick corbelling²⁶ has not found general acceptance and seems unlikely. In most cases the facts concerning the brick construction are so few that they can be summarised in a tabulated form (see below) but there are some details from certain of the tombs which can be stated individually.

21. Reisner, *op. cit.*, 59-61.

22. *ibid.*, 79-80 and Pls. 64-5.

23. *ibid.*, 77-8 and Pl. 62.

24. Brunton, G., *Qau and Badari*, I, 12-3.

25. Petrie, W.M.F., *Royal Tombs*, II, 15.

26. Reisner, G.A., *Tomb Development*, 355.

Tomb of Udimu: The bonding is type A1 throughout the lining of the pit, but in the fourteenth course from the base the bricks are laid on edge on the South and West sides of the tomb, to adjust the differences in level. All the walls were originally mud-plastered.

Tomb of Semerkhet: This tomb is remarkable in having the brickwork of the lower part of the walls bonded in C1, which is very rare at this period. In the higher courses the bond becomes A1 with occasional layers of edger-headers for levelling. Another example of a type C bond in the late First Dynasty occurs in mastaba VII at Abu Roash, excavated by Montet.²⁷

Tomb of Ka-a: The brickwork here is so irregular and rough that no distinct bond can be identified. Petrie considered that the careless nature of the brickwork was due to the fact that the defects would have been concealed by the wooden lining of the chamber.²⁸

SUMMARY

Site & Tomb	Dynasty	Bonds used	Brick Size (cm)	Notes
<i>Naqada:</i>				
T.15	Pre-	X1	—	
1037	Pre-	—	23.5 x 11 x 5.5	
<i>Tarkhan:</i>				
42	I	—	23 x 11.5 x 7.5	Plaster 2.5cm
195	I	A1	25 x 12.5 x 7.5	
414	I	X1	—	Plaster used.
1006	I	X1	23.5 x 11.5 x 7	Plaster 2.5cm
<i>Mahasna:</i>				
H.120	I-II	—	26.5 x 14 x 5.5	
H.128	I-II	'on edge'	26.5 x 14 x 6.5	
H.129	I	'on edge'	24 x 11.5 x 7.5	
<i>El-Amra:</i>				
b.8	I	—	25.5 x 12.5 x 7.5	
b.33	I	X1(1.0)	25.5 to 28 long	
b.137	II	—	—	Corbel of headers.
b.178	II	—	—	
<i>Hierakonpolis:</i>				
100 (Dec. Tomb)	Pre-	X2	? x 9 x 9 23 x 11.5 x 8	Floor paved with brick.
<i>Tura:</i>				
20.i.1	I	X1(0.5)	—	
<i>Qau:</i>				
443	I-II	—	} 26.5 x 11.5 x 7.5 25.5 x 12.5 x 7.5	
455	I-II	—		
1803	I-II	—	} 24 x 11.5 x 6.5	
509	I-II	—		
516	I-II	—	} 23 x 10 x 7.5	
518	I-II	—		
1592	I-II	—	28 x 14 x 7.5	518 corbelled.
1742	I-II	—		
<i>Abydos:</i>				
B.15	I	—	22.5 x 11.5 x 7.5	
B.19	I	—	24.5 x 12.5 x 7.5	
Djer	I	X1	24.5 x 12 x 6.5	
Merneit	I	—	22.5 x 11.5 x 6	
Udimu	I	—	24.5 x 12 x 7.5	
Adj-ib	I	—	25 x 12 x 7	
Semerkhet	I	C1, A1	23.5 x 11 x 6.5	
Ka-a	I	Irregular.	25 x 12.5 x 7.5	
Peribsen	II	—	24 x 11.5 x 7	
Khasekhemui	II	—	26.5 x 12.5 x 7.5	

27. Montet, *Kemf* 7 (1938), 11ff.

28. Petrie, *Royal Tombs*, I, 15.

Site & Tomb.	Dynasty	Bonds used	Brick Size (cm)	Notes
<i>Naga ed-Der:</i>				
1617	I	—	—	Mud plaster on all brickwork. Only average brick size given, @ 28 x 14 x 7
1649	I	—	—	
1631	I	X1(0.5)	—	
1525	I	—	—	
1634	I	—	—	
1606	I	A8(irregular)	—	
1638	I	A8(1.0)	—	
1532	I	A1(2.0)	—	
1533	I	A5, X1	—	
1581	I	A5, A8	—	
1584	II	X1(0.5)	—	This is the bond of the cross-walls. Corbel is of headers.
1619	II	X1(0.5)	—	
3022	II	X1(0.5)	24 x 12 x 6	
3014	II	X1(0.5)	—	
1605	II	A5(1.5)	—	
<i>Saqqara:</i>				
Subsid. graves				
of tombs 3503		X1(0.5)	—	Plaster inside.
3504		—	21 x 11.5 x 6.5	
3506		A1(1.0)	—	
Cemetery N.W. of Serapeum.	I	A1(1.0)	24 x 14 x 7.5 22 x 11 x 6.5	Average sizes. Bricks line the pit.

4. The Palace-Facade Mastaba.

The high level of competence which the Egyptians showed in their brick architecture during the First Dynasty is best displayed in the large panelled mastabas of the period. Since this study is concerned with the structural and technical aspects of brick architecture this is not the place for a discussion on the origin of the palace-facade. Suffice it to say that this style of building seems to have been one of the many influences which Protodynastic Egypt obtained from Mesopotamia.

Unfortunately, the published reports on the excavation of early mastabas are not all of the same standard, and from certain sites, therefore, the information about constructional details is limited. The panelled mastabas of Naga ed-Der, although worked out with meticulous care, were so denuded that barely a single course of brick remained. This study can therefore consider the following tombs.

The mastaba at Naqada, ascribed to Neith-hotep.

Saqqara Tombs 2185, 3035, 3036, 3038, 3111, 3357, 3471, 3503, 3504, 3505, 3506, 3507.

Tarkhan Tombs 1060, 2038, 2050.

Abu Roash mastaba VII.

Giza mastaba V.

In addition to this list there are tombs of the Second and Third Dynasties which revive the palace-facade, sometimes only for the East face of the mastaba. These are:

Saqqara Tombs 2405 and 3070.

Giza mastaba T.

The brickwork and associated structural details of each of these tombs will now be described separately.

The Naqada Mastaba.

The large palace-facade tomb ascribed to Neith-hotep at Naqada²⁹ is the earliest example of this type of funerary monument so far discovered. The early dating is supported by the fact that the burial chamber and subsidiary rooms at its ends were not sunk into the gravel, as in all later mastabas of this type, but stood on the ground surface. The core of the tomb consists of five chambers, the central one of which was that used for the burial. Between these rooms and the outer wall of the mastaba are sixteen magazines, whose cross-walls are interbonded with the exterior wall of

29. Borchardt, *ZAS*, 36 (1898), 87ff.

the tomb but not with the block of chambers in the centre. These chambers appear to have been laid out in cubit measurements.³⁰ The bricks used in the tomb are of the following dimensions:

29 x 13.5 x 7cm	26 x 13 x 8cm
26 x 12 x 7cm	25.5 x 12.5 x 7cm

For the intricate niche construction of the facade smaller bricks were employed, measuring 17 x 9 x 7cm thereby making the task of the builders easier when constructing niches of a specific size. On the face of the mastaba the bricks are frequently laid as stretchers, and, in some parts, as three layers of stretchers alternating with one of headers. However, the thickness of the main walls, behind the outer face, is composed entirely of headers placed together without taking care to off-set the lines of the joints. Bricks on edge occur rarely in the masonry, being used occasionally to even up the levels of the courses.

The Saqqara Mastabas

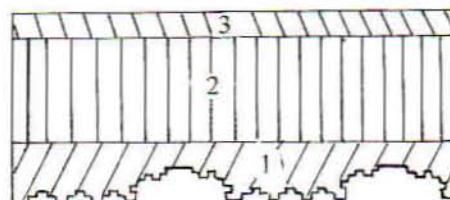
3357

This large mastaba³¹ of the time of Aha is enclosed within two encircling walls, both of which were covered with whitened plaster. The outer wall is bonded A11(3.0), a form of bonding not found in any other mastabas of the First Dynasty. The inner enclosure wall is built in the more common A3 bonding, except that the joints are not staggered as they are in later periods. This habit of not breaking the continuity of the joints is common at this time, especially in these Archaic tombs.

The walls of the tomb itself average 2.50 m across and consist of three sections. These are (1) an outer part in which the niches of the facade are built, (2) the central mass of the wall, and (3) a thin wall in a different bonding built around the inside and serving as a lining of (2). (See Fig.8) The first of these sections, the panelled facade, is constructed in this tomb of the same size bricks as the rest of the building, although half-bricks are used in some of the narrower niches. The projections which occur between the recesses are bonded into the body of the mastaba. Behind this crenellated face the core of the wall is composed entirely of headers, laid in the manner of tiles, with all the joints in line. In the tenth and sixteenth courses above the ground level layers of sticks were placed between the bricks to assist the bonding. These lie transversely in the wall and average 2cm in diameter, set in rows 3cm apart.³²

Against the inner face of this central part of the wall is a lining wall built in C5 bond, which may have been intended to cover the poorly-bonded brickwork behind it.

Fig.8 Sections of mastaba wall, tomb 3357



Within this superstructure were a series of magazines built above the pit. The dividing walls of these magazines were bonded C5 and did not interbond with the main walls nor with each other. The reason why they were not bonded into the mastaba is that their construction could not take place until the burial had been completed, as the only access to the burial pit was from above. These magazines would have been hastily built within an already existing superstructure.

The substructure of the tomb was roofed with wooden beams and planks, and the details of this roofing have been described by Emery.³³ The beams and planks were only let half a brick-length into the walls of the pit, and probably because of this the beams are set close together (every 15cm) to distribute the weight of the roof and to prevent the beams cutting into the brickwork.

All the bricks used in the structure were of a uniform size 23 x 12 x 7cm.

3471 (*Reign of Djer*)³⁴

The palace-facade of this mastaba is of the same type as that of 3357 and is constructed in similar fashion. In the core of the walls the bricks alternate two layers of headers with one of stretchers, without breaking the joints.³⁵ Layers of sticks occur, as in tomb 3357, but it is not known at what level these sticks were inserted. There is no lining on the inside of the main walls of this tomb.

The walls of the magazines in the superstructure present identical features to those of 3357, having the same C5 bonding and no interbonding with the mastaba or with each other. The use of the bond C5 is extended to the walls of the substructure, and the roofing beams are again set half a brick-length into the walls.

30. See Appendix I for a discussion of the metrology.

31. Emery, W.B., *Hor-Aha*, 10-8.

32. Emery, W.B., *Hor-Aha*, 15.

33. *ibid.*, 17.

34. Emery, W.B., *Great Tombs of the First Dynasty*, I, 13-7, Pls. 2-3.

35. The technique by which the joints are staggered in brickwork is known as "breaking joint".

There is a problem concerning the size of bricks used in this tomb. Emery records a measurement of 0.29 x 0.07m,³⁶ which cannot possibly be for the length and width of the bricks, but is more likely to be for the length and thickness, leaving the width unknown. Consequently, the size can be assumed to have been 29 x (?) x 7cm, but as a length of 29cm is exceptionally long at this period, the measurement must be regarded as dubious.

2185 (Reign of Djer)

This tomb was not reported in so much detail as the First Dynasty mastabas discovered by Emery, and so little can be said of its structure. The size and style of the tomb are very similar to 3471, described above, and the palace-facade had the same type of niche construction. Unfortunately, the brick size is not given in the report³⁷ and the photographs are not distinct enough to show details of bonding.

3503 (Reign of Djer, ascribed to Merit-Neith)

The construction of this mastaba³⁸ shows it to have been built during the reign of Djer, since it is identical in structure to tomb 3471. The main walls have the same arrangement of brickwork as used in that tomb, and the proportions of the recessed facade are in agreement. Both the walls of the magazines and of the pit are bonded C5. The brick size is not given by Emery, and I could not obtain it, since the tomb has by now been denuded down to the rock.

3504 (Reign of Uadji)³⁹

An enclosure wall surrounds the tomb, being 0.95 metres thick and built in bond A1. The bonding of the mastaba itself consists of three layers of stretchers alternating with one layer of headers, the bricks being laid like tiles with open joints. There is a lining wall on the inside of the superstructure, built in A1 bonding with reeds between every sixth course of brickwork.⁴⁰ The facade has niches of the same pattern as tomb 3471.

The magazine walls are bonded A3, and each magazine is lined with a layer of stretchers on the inner face of its walls. The presence of this lining makes the cross-walls appear to bond into each other, although in fact there is no real bonding, as shown in the diagram below.

Wood was used for the roof and floor of the substructure, and also for facing a series of brick pilasters which adorned the walls of the burial chamber.⁴¹ These pilasters originally had decorative strips of gold foil applied to them. Their construction is illustrated in Fig.10, where it can be seen how the edge of the wooden floor runs beneath the pilaster. The wooden facing of the pilaster was fastened to beams built into the brickwork, one at floor level and another nine courses above.

When the tomb was plundered the robbers set fire to the burial chamber, with the result that many of the bricks were baked red. Although the restorers of the tomb made use of some of these burnt bricks, the innovation was not generally adopted, and mud-brick remained the standard building material of Egypt.

The bricks themselves measure 21 x 11.5 x 6.5cm.

Fig.9 Brickwork of magazine walls, Tomb 3504.

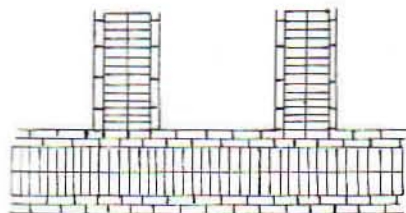
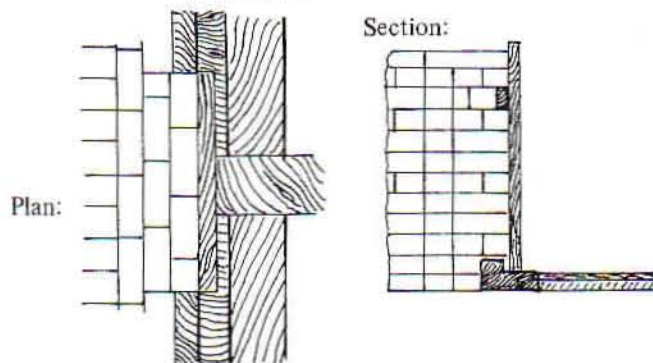


Fig.10 Wood-faced pilaster, Tomb 3504.



3035 (Reign of Udimu)⁴²

In the core of the exterior walls, the bricks are all headers, laid with open joints running right through the mass. Against the inner face of these headers is a lining wall of stretchers, one brick-length in thickness. The outer sides of the main walls have the usual niches, but the construction of these is facilitated by the use of specially small bricks measuring 17 x 5 x 5cm. The proportions of the large niches differ from those found in the tombs discussed above, having a greater width across the inner recess.

36. Emery, *op. cit.*, 17. Misprinted as 0.29 x 0.7m.

37. Quibell, J.F., *Archaic Mastabas*, 15-6, Pls. V-VII.

38. Emery, W.B., *Great Tombs of the First Dynasty*, II, 129-138, & Pls. XXXVIII-XLVI.

39. *ibid.*, 15-13 and Pls. I-XV.

40. *ibid.*, 8.

41. *ibid.*, 11.

42. Emery, W.B., *The Tomb of Hemaka*, 3-9.

In the magazines there is no bonding at the corners of the dividing walls, nor do the walls bond with the mastaba itself. The bond of these walls seems to have been A1 or A2. Above the magazines was a roof composed of beams and planks with five courses of brickwork laid on top of the roof. These bricks are laid with open joints in alternate layers of headers and stretchers.

The walls of the pit are retained by brickwork of rather irregular construction, with courses of stretchers, headers and edger-headers in no strict sequence. Except for the palace-facade, the tomb was built of bricks measuring 23 x 13 x 5cm.

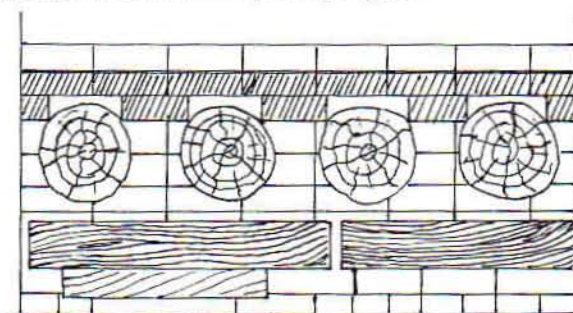
3036 (*Reign of Udimu*) ⁴³

Both the enclosure wall and the tomb itself are constructed of bricks 24 x 10 x 5cm in size, bonded A1. Most walls had reeds laid between every sixth course. ⁴⁴ There is no lining wall on the inside of the superstructure in this tomb.

The palace-facade is much simpler and shallower than that of tomb 3035 or the earlier tombs, and no special bricks are used in its construction. ⁴⁵

Within the superstructure are magazines divided by crosswalls built in A1 bonding. These walls interbond with each other at the corners, but not with the main walls of the tomb nor with the sides of the pit. The burial pit itself is roofed in a different way from any other of the Saqqara First Dynasty tombs, by using bricks for the roof. Wooden beams, 30cm in diameter, cross the chamber, and are set so close together that the gaps between them are spanned by bricks. This roof was then consolidated by another course of brick laid over the first. Below the beams is a ceiling of wooden planks, 14cm thick, with their edges set into the brickwork, as shown in Fig.11. A similar use of bricks for roofing occurs in tomb N.1647 at Naga ed-Der, for which see Reisner, *Naga ed-Der*, I, 19, especially Fig.10.

Fig. 11 Roofing of pit, Tomb 3036 at Saqqara.



3507 (*Reign of Udimu, ascribed to Herneith*) ⁴⁶

The main walls of the mastaba have three layers of headers alternating with one of stretchers, with reed matting every fifth or sixth course. ⁴⁷ There is no lining wall on the inside of the main walls. The cross-walls of the magazines are bonded with each other at the corners, and with the mastaba itself, showing that they were built at the same time as the main walls of the tomb. None of the magazine walls pass over the burial pit, but they join on to its retaining wall. This leads us to the view that the only access to the burial chamber after the building of the tomb was from directly above, through a brick-lined pit which penetrated the tumulus structure upon which the magazine walls stood. The roofing of the burial chamber could only have taken place after the burial, and must have been completed in the confined space of the pit (5.25 x 3.15m). Once the roof was in place the tumulus could be completed in its centre to cover the substructure. It seems rather strange to see the builders confining themselves to work in such a narrow space, instead of leaving the construction of the magazines until after the interment, as they did in all the earlier mastabas. The only alternative to this view is that the entire superstructure, including the main walls of the tomb, was built after the burial. Emery states ⁴⁸ that the bonding of the magazine walls was A8, but from the published photographs ⁴⁹ it seems to be too irregular for classification. The tumulus was cased with a single layer of bricks laid flat. ⁵⁰

The bricks measured 24 x 11 x 5cm, including those of the palace-facade, whose niches are of a simpler type than usual, omitting the small niches in the sides of the outer recess. ⁵¹

3506 (*Reign of Udimu*)

According to the published report ⁵² the main walls are built in an alternation of three courses of headers to one of stretchers, with reeds every fifth course. Whilst the face of the walls have this arrangement in parts, I found that the thickness of the wall was composed entirely of headers laid together with very little mortar. The inside faces of the walls have buttresses every four metres on the long sides, and every two metres on the short. These are 0.85m wide and are bonded into the mastaba. The palace-facade uses special bricks, ranging in size from 14 x 7 x 6.5cm to 15 x 7 x 7cm. This size occurs also in Mastaba 1060 at Tarkhan, ⁵³ and is probably intended to be 2 x 1 x 1 palms.

Tomb 3506 has no magazines within the superstructure, which was filled with sand.

43. Emery, W.B., *Great Tombs of the First Dynasty*, I, 71-5 & Pls. 14-7. 48. *ibid.*, 76. 49. *ibid.*, Pls. 92-3. 50. *ibid.*, 77.

44. *ibid.*, 75. 45. *ibid.*, 73. 46. Emery, *op. cit.*, III, 73-7 & Pls. 85-94. 51. *ibid.*, Pl. 85. 52. *ibid.*, 37-42, & Pls. 40-65.

47. Emery, W.B., *Great Tombs of the First Dynasty*, III, 76. 53. Petrie, W.M.F. and Wainwright, G.A., *Tarkhan I & Memphis V*, 14.

3038 (*Reign of Adj-ib*)⁵⁴

Only headers are used in the main walls of the mastaba, and no small bricks are employed for the facade. The niches are of the same type as those of Tomb 3471. No details are available of the construction of the stepped mound over the burial chamber, but the cross-walls within the superstructure are known to have been bonded A1, whilst the walls enclosing the pit were of type A2.

An interesting feature of the tomb are the brick-built granaries, which are roofed over by corbelling in the brickwork, and coating the outer surfaces with mud. The brick size is unfortunately not given.

3111 (*Reign of Adj-ib*)⁵⁵

The mastaba walls are built of headers, with an inner lining wall of stretchers. Buttresses occur along the inside of this wall, and there are no magazines in the superstructure. Instead, the pit is divided into seven rooms, but the bonding of the cross-walls is not recorded. The facade of the mastaba uses the same size of bricks as the rest of the structure, being 26 x 12 x 7cm.

3505 (*Reign of Ka-a*)⁵⁶

This is a large rubble-fill mastaba with outer walls built in A1 bonding. At every sixth course of bricks, reeds are laid transversely through the walls.⁵⁷ The facade has the usual niches on the North, South and East sides, but simplified on the West. Throughout the tomb the bricks are 23-4 x 10-1 x 7cm in size.

The remaining mastabas in the First Dynasty cemetery at Saqqara do not have the palace-facade, but instead have an offering niche at the South end of the East face. These tombs are discussed below, together with other plain mastabas of the Archaic Period, in Section 5. Further examples of palace-facade mastabas, however, are found at Tarkhan, Giza and Abu Roash.

The mastabas at Tarkhan.

There are three palace-facade mastabas at Tarkhan, all approximately dated to the reign of Uadji. The details are as follows:

1060⁵⁸

The bonding of the main walls seems to be intended to alternate layers of headers and stretchers, but there are many irregularities. Sticks and reeds are laid between the courses of brickwork to assist bonding.⁵⁹ Within this superstructure are dividing-walls, bonded A1, which are not built into the main walls. The bricks are 23 x 10 x 7cm in size, with a variation of ± 0.5 cm, whilst for the niches of the facade smaller bricks at 15 x 7 x 7cm are used. The recess just South of the centre of the East face has a wooden floor composed of five planks of wood, the outer one of which runs under the sides of the niche.

2050⁶⁰

This is a filled mastaba and consequently has no magazines in the superstructure. Two sizes of bricks were used: one of 24.5 x 11.5 x 6cm for the bulk of the tomb, and another of 17.5 x 8.5 x 6.5cm specifically for the palace-facade. In general plan and design this mastaba is very similar to number 2038, described below.

2038⁶¹

The bricks of this tomb were uniform throughout the structure measuring 25 x 12 x 7.5cm. The fourth recess from the South end of the mastaba, on the East side, has a wooden floor as in tomb 1060. No details of the bonding of the main walls are recorded.

In the East corridor of the tomb two subsidiary graves were found,⁶² having slightly vaulted superstructures resting on a sand filling. The brick covering, made of stretchers laid along the axis of the vault, was strong enough to be self-supporting when the sand filling had been removed, showing how a true vault could be produced by accident.⁶³

54. Emery, W.B., *Great Tombs of the First Dynasty*, 1,82-9 & Pls. 21-35.

55. *ibid.*, 95-7 and Pls. 36-7

56. Emery, *op. cit.*, III, 5-10 & Pls. 2-22.

57. *ibid.*, 8.

58. Petrie, W.M.F. & Wainwright, G.A., *op. cit.*, 13ff. & Pl. XV-XIX

59. *ibid.*, 14 and Pl. XVI

60. Petrie, W.M.F., *Tarkhan II*, 5-8 and Pls. XV, XVIII

61. *ibid.*, 4-5 and Pls. XV, XVIII

62. Petrie, W.M.F., *Tarkhan II*, 4-5. 63. *ibid.*, Pl. XVI

Mastaba V at Giza.

This large panelled mastaba, dated to the reign of Uadji, was partially excavated by Daressy⁶⁴ and finished by Petrie.⁶⁵ Few facts are recorded about the brickwork, but the brick size is known to be 21 x 10 x 6cm. Daressy states: "Les briques sont généralement couchées dans le sens de la longueur. . ." by which he must mean that there were mostly stretchers visible on the wall faces. Detailed measurements of the facade were made by Petrie, and these are discussed below in Appendix I.

Palace-Facade Tombs at Abu Roash.

Montet excavated a number of tombs at this site, of which numbers I, II, and VII were panelled mastabas. He gives little detail in his report⁶⁶ and only in the case of tomb VII is any information on the brickwork given. This mastaba had niches along the faces of the same type as those of Saqqara tomb 3507. The style of the mastaba dates it at the earliest to Udimu and at the latest to Ka-a. An interesting and unusual brick bond is used in both the tomb itself and in the enclosing wall. This bond is type CE1 of the Corpus, and uses headers and stretchers on their edges alternating with courses of bricks laid flat. The laying of bricks on edge is very unusual at this period, except when used in isolated groups to adjust the levels of the courses. In this tomb, however, the bricks are deliberately and regularly laid on edge, in a style which usually occurs only in the Roman age. It may be significant that there is only one other large monument of the First Dynasty which employs regular layers of bricks on edge, this being the tomb of Semerkhet at Abydos.⁶⁷ A point worth noting is that the bricks have to be made with the thickness equal to half the breadth to achieve the bond CE1, whereas the usual ratio of breadth to thickness is 3:2. The brick size itself is not given in the report.

Revival of Palace-Facade in Dynasties II and III.

Apart from the First Dynasty tombs so far described, there are certain mastabas of the Second and Third dynasties which revive the use of the palace-facade. The style persists into the Fourth Dynasty at Meydum, but there the niches are of a simplified form.⁶⁸ These examples from Meydum are dealt with in a later section. The other tombs to be considered here are Giza T, of the late Second or early Third Dynasty, and Saqqara 2405 and 3070, both dated to the Third Dynasty.

*Giza Mastaba T*⁶⁹

This is a very large tomb measuring approximately 55 x 28 metres. It is enclosed by a thick wall, built of bricks whose average dimensions are 24 x 12 x 8.5cm although some examples were down to 20 x 10 x 7cm. In the mastaba itself the size of the bricks was 24 x 12 x 8.5cm, like the larger ones of the wall. The palace-facade used special bricks measuring only 15 x 7 x 6.5cm. No details of the bonding are available.

*Saqqara Tomb 2405 (The Tomb of Hesy)*⁷⁰

The niched facade is limited to the East face of the mastaba and enclosed by a corridor chapel. The brick sizes are the only structural details recorded, being 21 x 13 x (?)cm for the mastaba and 14 x 7 x 7cm for the recessed panelling. As in all niched tombs a coat of plaster covered the facade, in this case being 2cm thick.

*Saqqara Tomb 3070*⁷¹

As in the tomb of Hesy, the panelling is enclosed in a corridor chapel on the East side of the mastaba. Special bricks measuring 10 x 5 x 5cm are used for the niche construction. However, the niches in the antechamber of the South chapel are made by a different technique. This involves the use of pre-cast mud slabs fastened to the mastaba by means of wooden plugs.⁷² The same material was utilized to make the lintels which occur over the offering niches of Archaic mastabas. Emery states that the mud was reinforced with strips of linen and dried under pressure,⁷³ but how this pressure was applied is unknown.

64. *ASAE*, 6 (1905), 99ff.

65. Petrie, W.M.F., *Gizeh & Rifeh*, 2-3 and Pls. II, VI

66. *Kemí*, 7, (1938), 11ff.

67. See above, p. 14.

68. Reisner, G.A., *Tomb Development*, 222-3.

69. Covington, D., *ASAE* 6 (1905), 193ff. & Petrie, *op.cit.*, 7 & Pl. VII

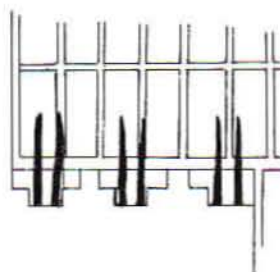
70. Quibell, J.E., *The Tomb of Hesy*, *passim*, Pls. I-VI.

71. Emery, *JEA* 54 (1968), 11-3

72. *ibid.*, 11.

73. Emery, W.B., *Archaic Egypt*, 182.

Fig. 12 Pre-Cast niches, Saqqara Tomb 3070.



SUMMARY: PALACE-FACADE MASTABAS

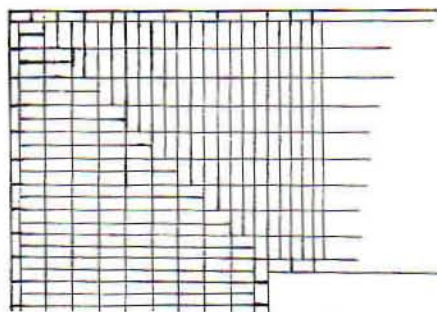
Site & Tomb	Bond, main walls	Cross-walls	Brick Size (cm)	Notes
<i>Naqada:</i> mastaba	A11, A7	—	29 x 13.5 x 7 26 x 13 x 8 26 x 12 x 7 25.5 x 12.5 x 7 17 x 9 x 7 (Niches)	Encl. wall bond A3
<i>Saqqara:</i> 3357	All headers	C5	23 x 12 x 7	Sticks between courses.
3471	2 layers of headers: 1 of stretchers.	C5	29 x ? x 7	
2185	No information available.			
3503	2 layers of H to 1 of S	C5	—	
3504	A7	A3	21 x 11.5 x 6.5	Encl. wall A1
3035	All Headers	A1, A2	23 x 13 x 5 17 x 5 x 5	Reeds every 9th course
3036	A1	A1	24 x 10 x 5	Encl. wall A1
3507	3 layers of H to 1 of S	Irregular.	24 x 11 x 5	Reeds every 5–6 courses
3506	A7	—	14 x 7 x 6.5 15 x 7 x 7	Reeds every 5th course
3038	All Headers	A1, A2	? x 11 x ?	
3111	All Headers	—	26 x 12 x 7	Simple niches
3505	A1	—	23–4 x 10–1 x 7	Reeds every 6th course
<i>Tarkhan:</i> 1060	Irregular A1	A1	23 x 10 x 7	Sticks & reeds used. Sand-fill mastabas.
2050	—	—	24.5 x 11.5 x 6 17.5 x 8.5 x 6.5	
2038	—	—	25 x 12 x 7.5	
<i>Giza</i> V	—	—	21 x 10 x 6	
<i>Abu Roash:</i> VII	CE1	—	—	Encl. wall also CE1
<i>Palace-Facade Mastabas later than the First Dynasty.</i>				
<i>Giza:</i> T	—	—	24 x 12 x 8.5 15 x 7 x 6.5	
<i>Saqqara:</i> 2405	—	—	21 x 13 x ? 14 x 7 x 7	Solid brick mastaba
3070	A3	—	10 x 5 x 5	Small bricks for niches.

5. Archaic Mastabas of Plain or Two-Niche Type.

Palace-facade disappears at the end of the First Dynasty, and the standard mastaba of the remainder of the Archaic Period has plain walls, usually with a North and South offering niche. Examples of this type begin to appear in the late First Dynasty at Saqqara, most dating from the reign of Ka-a. The most important of these is Saqqara Tomb 3500,⁷⁴ the subsidiary graves of which have been described above, on pages 10-11. The other tombs of this group are 3120, 3121, 3338 and "Tomb X",⁷⁵ the last being a solid mastaba. As the information about the brickwork of these tombs is rather meagre, it is all given in tabular form on page 25.

The following general observations may be made about the construction of mastabas of the Second and Third Dynasties:— They are usually composed of a thick outer wall of brick, with a rubble or mud filling. Small tombs, however, are frequently made of solid brickwork, and this method of construction is extended to large mastabas in the Third Dynasty for example Saqqara 2405.⁷⁶ The common, almost universal, bonding of the main walls is type A2 or A3, whilst A6 occurs less frequently. The use of these bonds means that the great mass of the brickwork is composed of headers only, laid perpendicularly with respect to the face of the wall. This leads to the formation of a diagonal joint through the angles of the mastaba. (See Fig.13)

Fig.13 Corner bonding in typical mastaba.



Many tombs have layers of edger-headers showing in the brickwork, these being used for levelling. The use of bricks on edge raises the level of the course by about 4cm with bricks of this age, thereby enabling the builders to compensate for sloping ground or irregularity of the horizontal joints. This way of dealing with changes in level was used in Egyptian brickwork at all periods. The bricks are most often composed of black mud and chopped straw, but there is also frequent use of bricks made from desert *tafl* (desert gravel). These contain just sufficient mud to hold the gravel together, and have a distinct pale yellow colour. They are most common in the smaller mastabas at this period, but are used for all sizes of tombs in the Old Kingdom. The size of the bricks is very little different from that used in the First Dynasty, although there is a tendency towards a slight increase. Most frequently the bricks are 22–26cm in length. In nearly all cases the brickwork is covered over with a coat of whitened mud-plaster. This plaster contains a great amount of chopped straw (*Arabic tibun*) to give it protection from weathering. Mud is also used for the mortaring of the joints, although sometimes *tafl* is utilized for this purpose. The mortaring is carelessly done, and is confined to the horizontal joints.

Naga ed-Der.

The Second Dynasty corbelled tombs at this site have already been described (p.12); their superstructures are known to have been mastabas but hardly any brickwork has survived. There are a number of small mastabas with North and South offering niches at the site, examples being N.4771, 5302 and 4506.⁷⁷ Their construction is very uniform, the walls being built in type X1 or A6 bonding, and the bricks averaging 26 x 12.5 x 7cm in size. Most of these tombs have vertical outer walls, but some have a slight batter on the face. In early examples this batter is obtained by leaning the entire wall inwards from the base, but later by stepping the bricks inward slightly every second course.⁷⁸

Beit Khallaf.

Tomb K1.

This is a very large (86 x 46m) solid brick mastaba dated to the reign of Djoser.⁷⁹ Practically all the bricks are laid as headers, although it is likely that the original face would have showed alternate courses of headers and stretchers, these having weathered away. The brickwork was laid in sections from the exterior inwards, finishing at

74. Emery, W.B., *Great Tombs of the First Dynasty*, III, 98-102, and Pls. 114-120. 75. *ibid.*, I, 107-129.

76. See Quibell, J.E., *The Tomb of Hesy*. 77. Mace, A.C., *Naga ed-Der*, II, 22-24. Other exx. in Cemetery 500 are N.574, 585 & 689. See Reisner, G.A., *Naga ed-Der*, III, 220, 224, 245-6. 78. Mace, *op. cit.*, 11.

79. Garstang, J., *Mahasna and Beit Khallaf*, 8-11, Pls. VI-VII

the stairway and shafts. The construction of the brickwork in sections, separated by a clean joint right through the mass, may have been to allow the bricks to dry out, but is more likely to be connected with an internal tumulus structure as existed in Saqqara Tomb 3038. An important innovation occurs in the descending passage of the tomb, as this is roofed by a brick vault, resting at its upper end on a brick arch. This is paralleled by another example from tomb K2 at Beit Khallaf. The arch is composed of bricks on edge (type c1) and is a single course in thickness.⁸⁰

*Tomb K2.*⁸¹

Like tomb K1, this mastaba is built in sections and has a vaulted stairway passage. It is dated to the time of Sanakht and is a twin mastaba with North and South shafts. The vault over the stairway is built in inclined courses (type d1 of the Corpus) and rests against an arch of type c1(0.5). In some cases the bricks of the arch have been shaped into the required wedge-form by chipping or by adding mud.⁸² This is the earliest well-attested arch so far discovered in Egypt.

The other large mastabas at Beit Khallaf are not reported in detail, but tomb K5 had a corbel-vault over the descent to the substructure.⁸³ It is strange that corbelling should be used here when true vaults were being employed in the nearby tombs K1 and K2.

Reqaqnah

Two tombs at this site date from the Third Dynasty: numbers R1 and R40.⁸⁴ Both of these employ the type c1(0.5) arch over the descending passage, and R1 has vaults used in conjunction with the arches.⁸⁵ The exterior faces of mastaba R1 show alternate courses of headers and stretchers, so the thickness bonding is most probably A2 or A3.

Tura.

Tomb 27.w.1

This is a sand-filled mastaba with a brick-lined shaft.⁸⁶ The walls of the pit are bonded with two layers of stretchers to one of headers, and some bricks on edge are used for levelling.

Saqqara.

This is the largest cemetery of the Archaic Period, but it is unfortunately only partly published. Quibell excavated a large number of tombs of the Second and Third Dynasties, the majority being rubble-filled brick mastabas.⁸⁷ The brick bonding in these tombs is not too regular A1, A2 or A3, the choice between the last two being dependent on the thickness of the wall. Some tombs also make frequent use of bond A6, which is the same as A3 except that the stretcher course is doubled. Most of the tombs are built of black mud-brick but some of the smaller mastabas use *tafl*-bricks, examples being 2131/2, 2149, 2166 and 2370. The constructional features of the Archaic mastabas at Saqqara are so uniform that they can be collectively described: The brickwork was invariably covered over with whitened mud-plaster, from 2 to 6cm in thickness, although a few tombs use yellow plaster made from *tafl*. Mortar was placed in the horizontal joints only, and is far more frequently composed of *tafl* than of mud. Layers of reeds occur between the brick courses in many tombs, and are laid both along and across the axis of the walls. The shafts and stairways of the mastabas are often strengthened and retained by brick walls, bonded A1, and the stairs themselves are sometimes built of brick, each step being formed of a layer of headers over a layer of stretchers. In other cases a single course of brick on edge is used for the step. The sizes of the bricks are fairly closely graduated in this cemetery, as the examples below illustrate:

24—5 x 12 x 7—8cm
24—5 x 11.5 x 6.5
26 x 12—12.5 x 10
22.5 x 12 x 8
21—2 x 10.5 x 7
20 x 10 x 7
21 x 10.5—11 x 6

80. Garstang, J., *The Third Egyptian Dynasty*, Pl. 14.

81. Garstang, J., *Mahasna and Beit Khallaf*, 11-2, Pls. XVII-XVIII.

82. Garstang, J., *The Third Egyptian Dynasty*, Pl. 14.

83. Garstang, J., *Mahasna and Beit Khallaf*, 15, Pl. XXV.

84. Garstang, J., *The Third Egyptian Dynasty*, 21-3, Pls. IVA and B.

85. *ibid.*, Pls. 5, 6 and 14.

86. Junker, H., *Friedhof in Tura*, 25-6.

87. Quibell, J.E., *Archaic Mastabas*, *passim*.

Here the sizes all fall between 20 and 26cm for the length, whilst the breadth varies less, from 10 to 12.5cm. Bricks seem to have been of a fairly uniform small size throughout Egypt at this date, and these figures may be compared with a range of brick lengths covering 24–28cm at Qau⁸⁸ and 24–26cm at Naga ed-Der.⁸⁹

Apart from the great mastaba-tombs of the Archaic Period, small vaulted graves were discovered at Saqqara by Quibell,⁹⁰ examples being QS.2125 and 2126. These are covered by a brick vault, built in c1 bonding, and a single course in thickness. The gaping joints between the bricks on the outside of the arch were filled with potsherds. These arches are of the same type as those in the mastabas at Beit Khallaf, and belong to the same dynasty. Arches are used only over short spans at this date; that of QS.2125 covers 0.92m.

The table below summarises the details of the tombs described in Section 5 and includes supplementary information from cemeteries which do not merit individual treatment.

SUMMARY

Location	Bonds used	Brick Size (cm)	Notes
<i>Beit Khallaf:</i>			
K1	A2 or A3	28 x 12.5 x 9	Vault of type d1 and c1 arch in shaft.
K2	—	—	d1 vault and c1 arch in shaft.
K5	—	—	Corbel-vault in shaft.
<i>Reqaqnah:</i>			
R1	A2 or A3	—	c1 arches and d1 vault in shaft.
R40	—	—	c1 arch in shaft.
<i>Tura:</i>			
27.w.1	2 layers of S to 1 of H	—	Edger-headers for levelling.
<i>Qau:</i>			
419	—	24 x 11.5 x 6.5	These dimensions are from substructures of tombs at Qau, included here for comparison.
483			
485			
504			
551			
562			
829			
402	—	25.5 x 11.5 x 7.5 to 26.5 x 11.5 x 7.5	All these tombs are dated to S.D.79–84.
443			
484			
514			
855			
816	—	28 x 13 x 8 to 28 x 14 x 9	
852			
1562			
1738			
1742			
3112	—	25.5 x 11.4 x 6.5	Dated by vase fragments to Hetepsekhemui.
<i>Naga ed-Der:</i>			
4506	2 layers of S to 1 of H	—	—
5147	X1	—	—
5104	A1	—	—
528	X1	24.5 x 13.4 x 6	—
<i>Armant:</i>			
1207	—	23 x 11 x 8 26 x 13 x 6 26 x 11.5 x 6	—

88. Brunton, G., *Qau and Badari*, I, 13.

89. Mace, A.C., *Naga ed-Der*, II, 10.

90. Quibell, *op. cit.*, Pl. XXXII

Location	Bonds used	Brick sizes (cm)	Notes
<i>Saqqara:</i>			
3500	Class A	22 x 12.9 x (?)	Sand-fill mastaba.
3338	A1	24 x 11 x 5	
3120	A1	22 x 11 x 8	
3121	A1	22 x 11 x 8	
Tomb X	A1	24 x 10 x 5	Solid brick tomb.
2307	—	25 long.	
2173D	—	27 x 14 x 8.5	<i>tafl</i> bricks
2172E	—	22 long.	
3030	A2 or A3	22 x 11 x 9	
3050	A2 , A3 some A6	24—5 x 12—12.5 x 7—8	<i>tafl</i> mortar. Edger-headers for levels.
3518	A2 , A3	21—2 x 10.5—11 x 7	Reed layers in brickwork.

Helwan: Some Type A bonding in mastabas. Plaster over brickwork. No other information available.

For more information on the brickwork of archaic mastabas at Saqqara, see the chapter by A.J. Spencer on the brick architecture of the site, in the final report of the recent excavations by the Egypt Exploration Society. (Forthcoming)

6. Brick-built Tombs of the Old Kingdom and First Intermediate Period.

The mastaba continues as the standard type of tomb throughout this period, but many examples are made of stone and have no brickwork in their structure. Mastabas built wholly or partly of brick are not, however, uncommon and the use of vaulted chambers is greatly extended in both superstructure and substructure. Corbel-vaults are also common for covering the burial, but, unlike the corbelled graves of the Second Dynasty, these have no stairway entrance to the substructure. The features of the brick construction are illustrated by the descriptions of particular monuments given below.

Giza.

At the West extremity of the great cemetery of stone mastabas West of the pyramid of Khufu, there lies a group of small brick tombs which were excavated by Fisher.⁹¹ These are rubble-filled mastabas with brick casing-walls and shafts. The bricks of the outer walls are stepped inwards slightly at each course to give a batter to the face, or alternatively, this is produced by thickening the wall towards its base. (Fig.14) Among the earlier tombs the bricks have sizes of 35 x 17 x 11.5cm, or as little as 28 x 15 x 9cm. Later, bricks up to 44 x 22 x 18cm are used, although the average is less than this. The casing walls are one or one and a half brick-lengths in thickness, and are bonded A1 or A2, as are the retaining walls of the shafts.

Fig.14 Types of brick casing-walls, Giza



All the exposed brickwork was originally coated with mud-plaster, which in many cases is of a yellow colour in this cemetery. Arches of type c1 are used above doorways, and d1 or cd1 vaults cover the chambers in the superstructures. Some of these vaults are especially interesting because they are built with specially-formed bricks, with rounded mouldings on their edges, to imitate the appearance of a primitive vault of reeds.⁹² For this reason the plaster on the undersides of the vaults is usually painted red, the colour of dried reeds. Examples of these “reeded” roofs occur in tombs G.2098 and 3033. Further use of special vaulting bricks was found in some tombs excavated by Abu Bakr in 1949–50.⁹³ Two of the mastabas discovered had bricks shaped to copy reed vaults, and in one case, the tomb of Neferi, these bricks were employed to build a very flat arch, not the semicircular vault generally found in Egyptian architecture. These special bricks are discussed in Chapter 15 and the details of the arches in which they occurred are included in Chapter 11.

Some examples of domed roofing are known from the Giza cemetery. The tomb of Seneb had a chamber covered by a dome⁹⁴ formed of courses of stretchers in circles, tilted inwards by raising the outer edges with chips of stone. Consequently the circles decrease in diameter as the height increases, and also incline inwards until they meet at the apex. A similar roof was used in the mastaba of Neferi, in which was the flat arch mentioned above.

91. Fisher, C., *The Minor Cemetery at Giza*.

92. Fisher, C., *op. cit.*, 65 and 116-7.

93. Abu Bakr, *Excavations at Giza 1949-1950*, 130-1

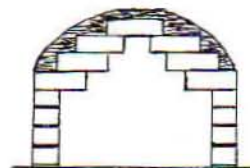
94. Engelbach, R., *Ancient Egyptian Masonry*, 186. & Junker, H., *Giza V*, 30-3.

Some brickwork occurs among the stone mastabas at Giza in the construction of exterior offering chapels, which were roofed with vaults of type d1. In tomb G.1203, the well-preserved North wall of the offering room had four windows formed of slits in the brickwork five to seven courses high, separated by partitions half a brick wide.⁹⁵ A similar window was found in G.1406. Other examples of exterior brick-built chapels occur in G.1205, 2100, 4360, 4460 and others.

Tura

In the cemetery at Tura some closed corbelled graves were found,⁹⁶ belonging to the Fourth or Fifth Dynasty. An example is tomb 10.p.5, which has lining-walls consisting of four courses of stretchers, above which are another four courses of brick for the vault. These are laid as headers with a thick coating of mud on the outside. (Fig.15) Grave 27.v.1 was also of this type.

Fig.15 Section of tomb 10.p.5 at Tura.



Abusir

Around the temple of the pyramid of Neuserre are several brick tombs of the Fifth or Sixth Dynasties.⁹⁷ Those of the Fifth Dynasty originally had external vaulted brick chapels, such as occur at Giza. The later graves consist of small brick mastabas with the burial chambers roofed by d1 vaults. Other vaulted tombs occur near the Solar Temple of Userkaf,⁹⁸ slightly to the North of the pyramid field; these graves employed vaults of type c1(1.0).

North Saqqara

Brick is used in the construction of various types of tombs at North Saqqara, in some cases for the entire structure and in others only as a casing around a stone core. There are a number of examples of the latter use in mastabas of the Fifth Dynasty; the inner part of the solid superstructure is built of roughly-laid stone blocks, around which is a casing of brick about a metre in thickness, leaning inwards against the stonework. The bricks used for the casing are very often made of desert *tafl* and usually measure 28 x 14 x 9 to 30 x 14 x 8cm, although larger sizes can occur. The bonding of the brickwork is generally of the A2 type, and black mud-plaster is very common over the surfaces. Some tombs have a number of simple niches in the East face, and broken-off stretchers are used occasionally to simplify the construction of these.⁹⁹

Brick is used in conjunction with stone in certain tombs for purposes other than making an outer casing for the mastaba. In many instances the position is reversed, and the casing is stone-built whilst the inner core is of brick. Examples of this occur in the Teti and Unas pyramid cemeteries, where brick is also frequently used for vaulted roofing and lining shafts. The descriptions of individual mastabas given below show the characteristic points of the brickwork in the different forms of tomb.

Teti Pyramid area.

*Khui*¹⁰⁰

The tomb is small, with two chambers roofed by d1 vaults formed of a single course of *tafl*-bricks measuring 26.5 x 13 x 7cm. The largest span is 1.35m.

*Desi*¹⁰¹

This tomb also has two vaulted chambers, the vaulting being type cd1(1.0). The plaster on the underside of the vault was painted red, a feature noted also at Giza. (See above, p.25) All the bricks measure 22-4 x 12 x 8cm, and they are bonded very roughly and irregularly in the outer walls. Over this poor brickwork is a thin coat of grey mud-plaster in

95. Reisner, G.A., *History of the Giza Necropolis*, I, 188.

96. Junker, *Friedhof in Turah*, 20-1, & Pls. XVII-XVIII

97. Borchardt, L., *Grabdenkmal des Königs Neuserre*, 109-134, 141-156, and Pls. 20-7.

98. Rieke, H., *Das Sonnenheiligtum des Königs Userkaf*, I, 34.

99. For more information on the brickwork in tombs of this type, see the publication quoted on page 25.

100. Saad, Z.Y., *ASAE* 43, 455-6. 101. Drioton, E., *ASAE* 43, 505-6 and "E" on plan.

which lines have been drawn to imitate the appearance of well-bonded courses of headers and stretchers in alternation. This is an interesting example of an attempt by the builders to hide bad internal work under a fine facade, and the technique is illustrated in Plate 46A.

Unnumbered mastaba West of the Tomb of Mereruka.

A large mastaba, now mostly buried, was excavated by ZY. Saad at this site,¹⁰² and it is of interest because of the dimensions of the mud-bricks of which it is built. These are 52—3 x 26 x 19cm in size, which is certainly intended to be 7 x 3½ x 2½ palms, or 28 x 14 x 10 common digits. It is interesting to note that the tomb of Ka-em-heset, which lies only a few metres to the south of this mastaba, also used bricks of this size, and furthermore had pillars composed of bricks a cubit square (53 x 53 x 23cm).¹⁰³

Further information on tombs in the Teti Pyramid Cemetery is given in the table on page 34.

Unas Pyramid area.

*Tomb of Haishtef.*¹⁰⁴

Brick is used for the body of the mastaba, whilst the walls of the internal chambers were lined with stone. The bricks are composed of mud containing limestone chips and potsherds, and are laid in A2 or A3 bonding with reeds between the courses at irregular intervals. There is very little chopped straw in the bricks, which measure 31 x 15.5 x 8cm. On the North side of the tomb there are three arches in the brickwork; two are dummies for the sake of symmetry, but one leads by an arched tunnel to the burial shaft. This tunnel is roofed with an arch of type c1(2.5), a form of bonding also used in the other arches, but they have two courses of bricks in place of five. The span of the main tunnel is 1.55m, and its side-walls are built of stretchers.

*Tomb of Impt.*¹⁰⁵

The brickwork of this tomb has been greatly eroded, but enough remains to show that the bricks were similar to those used in the mastaba of Haishtef, having potsherds and stones included in them and being 32—3 x 16 x 11cm in size. They were laid in mortar formed of *tafl*, and in A1 bonding, but no reeds were placed between the courses.

*Tomb of Mehu.*¹⁰⁶

Against the East side of this stone mastaba is a mass of brickwork, bonded A2, and consisting entirely of *tafl*-bricks measuring 30—1 x 14.5 x 9cm.

*Ka-irer.*¹⁰⁷

Bricks of dark grey mud, 27 x 13 x 8cm in size, are used in this tomb. The bonding is A1 and is rather rough, the irregular gaps in the work being filled up with gravel and plastered over with mud.

Built against this tomb is another mastaba whose owner is unknown. The bricks here are larger, at 36 x 18 x 11—12cm, and are bonded A2 to some degree. Some parts of this brickwork are very rough and use bricks on edge or lumps of mortar to close the gaps.

There are a number of smaller mastabas in the Unas Pyramid Cemetery which have remains of brick construction, and details of these are included in the summary on page 34. The use of both mud- and *tafl*-brick, the class A bonding, and the employment of mortar made from *tafl* are characteristic features of these tombs.

A few brick tombs at Saqqara stand away from the Old Kingdom pyramid cemeteries, to the North and West of the Step Pyramid enclosure, the most interesting of these, from the structural viewpoint, being the mastaba of Sebekemkhet.¹⁰⁸ This is built entirely of yellow *tafl*-bricks measuring 33 x 16 x 12cm, bonded A1 in the thinner walls and A2 in the thick masses of brickwork. Reeds occur between the bricks, laid both transversely and longitudinally in the walls, five courses apart on the North side. On the West face of the tomb is a door roofed by a c1 arch of a single ring of brick; another arch on the East side is also c1 but is two courses in thickness. A vault of type d1 is used to cover one of the internal rooms in the superstructure. Some attempt has been made to point all the joints on the faces of the walls, but in the inner work the mortar is rough and limited to the horizontal interstices only.

Two brick mastabas stand in the area just North-East of the famous tomb of Ptahhotep, both built in A3 bonding. The bricks contain numerous inclusions of stones and potsherds, just like the bricks of certain tombs in the Unas Pyramid Cemetery. Both of these mastabas originally had mud-plaster on the outer surfaces of the walls to a thickness of 1—1.5cm. The brick sizes are given in the table on page 34.

102. Saad, *ASAE* 43, 452 and Pl. XXXVII A.

103. Quibell, J.E. & Hayter, A.G.K., *Teti Pyramid, North Side*, 19-20.

104. Saad, Z.Y., *ASAE* 40 (1940), 685-6.

105. For position, see Spencer, A.J., *Orientalia* 43 (1974), Pl. I.

106. Saad, Z.Y., *op. cit.*, 687-690.

107. For position, see Spencer, A.J., *Orientalia* 43, (1974), Pl. I.

108. Lauer, J.P., *ASAE* 53 (1955), 155-9 and 55 (1958), 207-51.

South Saqqara.

The tombs of South Saqqara, dating mostly from the Sixth Dynasty, make extensive use of brick vaults to roof the chambers, both above and below ground. Two mastabas excavated by Maspero,¹⁰⁹ belonging to Rokhu and Nenki, each have a strong brick vault over the burial chamber, in one case three courses in thickness, and in the other four. In both examples the bond used is type c1.

The tombs discovered by Jéquier¹¹⁰ around the pyramid of Pepi II are of similar form. A brief list of the main features of brickwork in these mastabas will show the types of vaulting in common use.

M.III. (Tomb of Idi).¹¹¹

The descending passage is covered by a brick vault two courses thick, and another vault, of four courses, stands over the roof of the burial chamber. This latter is to take the pressure off the stone roofing of the chamber. The larger vault is built in cd1 bonding, the inner inclined rings supporting the bricks above.

M.V.¹¹²

The pits give access to burial chambers roofed with vaults of type d1.

M.VI.¹¹³

The substructure has brick relieving arches over the stone roofs, whilst at ground level are two rooms with vaulted roofs of type c1(3.0).

M.VII.¹¹⁴

Brick relieving arches cover the stone roof of the burial chamber.

M.X.¹¹⁵

The pit communicates with the burial chamber by means of a passage roofed with a c1(4.0) vault.

The remainder of the tombs in this cemetery also make much use of brick arches and vaults. Common bonds employed for these are c1 or cd1, with much mud-plaster covering the brickwork. The walls of the mastabas are usually bonded A1 or A2.

Dashur.

The group of tombs just North of the pyramid of Amenemhat II, and dating from the time of Sneferu, is comprised of small brick mastabas, some of which were faced with stone.¹¹⁶ The only feature which can be noted is the frequent use of brick vaults to roof the chambers in the superstructure. No details of the construction of these vaults are available. Close to Tomb 1 a brick wall was discovered, built on a wavy plan like the enclosure walls of certain Middle Kingdom pyramids. De Morgan dated this wall as contemporary with the mastabas,¹¹⁷ showing that this mode of construction was not a feature of the Middle Kingdom only.

The other mastabas of the Old Kingdom at Dashur, those South of the pyramid of Sesostri III, also show the use of arches and vaults. Tomb 7 of that group has a number of small chambers roofed with vaults of type c2(0.5).¹¹⁸

Meydum.

A series of mastabas at Meydum were originally built with plain walls with North and South niches, but were later modified by the addition of an outer coat of brickwork, which, besides retaining the main niches, added simplified panelling on all four sides of the tomb.¹¹⁹ Details of the construction of this panelling are not recorded, except for some brick sizes from tombs 16 and 17.¹²⁰ These measurements are stated in the table on page 34.

The substructures of the Meydum tombs are largely built of stone, but a few make use of the brick arch to cover the entrance passage. In number 393 of Rowe¹²¹ the vault consists of four rings of brick, but the bonding is not clear. Tomb 552 used an arch of type c1, resting on stone walls as springing, and spanning about two metres.¹²²

109. Maspero, G., *MMAF* 2, 194-6.

110. Jéquier, G., *Contemporains de Pepi II*, *passim*.

111. *ibid.*, 9-23.

112. *ibid.*, 30-2.

113. *ibid.*, 32-40.

114. Jéquier, G., *op. cit.*, 40-54.

115. *ibid.*, 62-6, and fig. 73.

116. De Morgan, J., *Fouilles à Dachour*, 1894-5, 1-23.

117. *ibid.*, 3.

118. *ibid.*, Mars-Juin 1894, 13-4.

119. Petrie, W.M.F., *Meydum*, 15.

120. Petrie, W.M.F., *Meydum and Memphis III*, 17 and 22.

121. Reisner, *Tomb Development*, 208-9.

122. *ibid.*, 209.

Some of the mastabas in this cemetery had timber ties built into the brickwork in irregular fashion. These ties were not necessarily straight logs, but had branches running off in various directions, so much so that Petrie at first thought that an entire tree had been built into the structure of the tomb of Rahotep.¹²³

Dara.

At this site, near Manfalut, a mastaba cemetery was discovered¹²⁴ containing some extremely large tombs of the late Sixth Dynasty.

*Mastaba of Idi.*¹²⁵

A large square tomb within an enclosure wall, with multiple shafts and a chapel on the East side. The enclosure wall seems to be intended to measure 100 x 100 cubits, whilst the mastaba is 50 x 50 cubits. The internal chambers are covered by d1 vaults, that over the burial chamber being ten courses thick. Over the doors and passages c1 arches are used, from 2–3 courses in thickness.

*Edifice M.*¹²⁶

This was once thought to be a destroyed pyramid, but it is in fact a large square mastaba of 130 metres (250 cubits) along each side. A tunnel enters through the North face and continues as a descending ramp with arches of type c1 over it at intervals. The entrance tunnel is roofed with a very strong cx2 arch, with eleven courses of brick remaining. Weill states that a further five courses had been lost from the inside,¹²⁷ but Pillet, writing in the same report,¹²⁸ does not mention this. The two authors also differ over the construction of the arch, Pillet stating that earth centring was probably employed, but Weill claiming that no centring was used at all. In this respect I consider it certain that the former opinion is correct, since an arch of this size and of this bond could not have been built without some form of temporary support during construction.

Reqaqnah.

There are several tombs of the vaulted and corbelled type in this cemetery, some enclosed by walls with offering niches, whilst others were simple graves in the sand. Tomb R.56 had a corbel-vault similar to those at Naga ed-Der, built mainly of headers mortared with mud.¹²⁹ In graves R.59 and 251 the corbelling was rounded to imitate burial under a pot.¹³⁰ (cf Naga ed-Der 771, below) The lowest course of brick is laid on end, with horizontal layers above. A thick coat of mud covers the corbel to help solidify the structure.

True vaults were used in tombs R.80 and 110,¹³¹ the former being enclosed by a wall with an offering niche. The vault of R.80 is built in inclined courses (type d1), whilst that of R.110 corresponds to type cx1 of the Corpus. The inner ring of stretchers has a half-brick at the apex to fill up the space.¹³²

A more unusual covering for the burial occurs in R.66, in which the lined pit is roofed by a flat cover of brick.¹³³ This is made of two bricks cantilevered out from the edge of the pit, as shown in Fig.16.

Naga ed-Der.

The Old Kingdom tombs at this site consist of small mastabas with a simple South niche, the walls being constructed in A1 or X1 bonding. In some cases these mastabas have their shafts revetted with brickwork.

More interesting, from the point of view of the brick construction, is the frequent use of the corbel vault to cover the pit or burial. Some of the corbels are small and rounded, imitating the pot-burials which are common at this period. There are also some graves which use a true vault over the burial instead of corbelling.

*N.645.*¹³⁴

The mastaba superstructure has outer walls built on a foundation layer of bricks on edge, to even up the level of the ground. The pit is lined with nine courses of stretchers, which interbond at the angles. Resting on these lining walls was a corbel-vault of eleven courses, built almost entirely of headers, and covered over with mud. The bricks were radiated around the corners to produce a vault of oval shape.

123. Petrie, W.M.F., *Medum*, 16.

124. Weill, R. & Pillet, M., *Dara*.

125. *ibid.*, 93ff.

126. Weill, R. & Pillet, M., *Dara*, 7ff.

127. *ibid.*, 9.

128. *ibid.*, 119.

129. Garstang, J., *The Third Egyptian Dynasty*, Pl. 14.

130. *ibid.*, Pl. 27.

131. *ibid.*, Pl. 23.

132. *ibid.*, Pl. 14.

133. Garstang, J., *The Third Egyptian Dynasty*, 46 and Pl. 23.

134. Reisner, G.A., *Naga ed-Der*, III, 242 and Pl. 28.

Fig.16 Reqaqnah R.66.

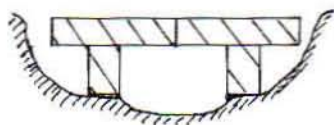
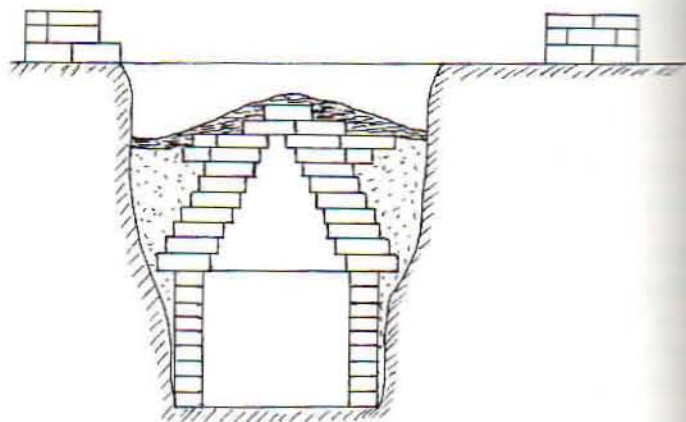


Fig.17 Naga ed-Der N.645.



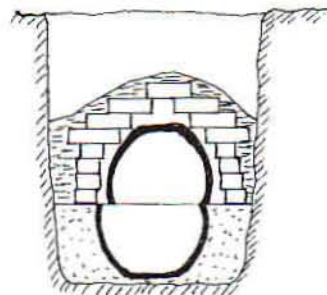
N.760.¹³⁵

This is a small mastaba standing over a brick-lined pit, roofed with a corbel-vault. The lining consists of five courses of stretchers on one side and six on the other, so the vaulting starts at a different level on the opposite sides. The corbel is five courses high, covered with mud, and has mud-mortared joints. On the top of the vault rested the gravel filling of the mastaba.

N.771.¹³⁶

The burial is covered by a large pot, and it is over this pot that the brick corbel was constructed. For this reason a circular vault was built, by using radiating circles of headers for the upper courses and rings of stretchers below. The details of this arrangement can be seen in the section in Fig. 18. The vault was coated externally with mud, and stood beneath a small mastaba.

Fig.18 Section of N.771



N.781 and N.787.¹³⁷

These two tombs have mastaba superstructures above corbel-vaulted burials and are similar to one another, except for the wooden coffin¹³⁸ of N.787. In both tombs the corbelling rests on the brick lining of the pit, and much mud-plaster covers the brickwork. The details of the brick arrangement are shown in Fig.19, where the corbelling is shown to be made of headers. In the case of N.781, the vault is topped by two layers of brick on edge, laid straight across the radiating headers below. This feature is also found in N.791,¹³⁹ which is of very similar form to these two tombs.

N.985.¹⁴⁰

The superstructure is destroyed but the grave has a well preserved corbel-vault, covering an area of 1.56 x 0.90m. The construction of the vault is rather irregular; it consists mostly of headers, with occasional stretchers here and there. Two courses on the North side are laid on edge in order to equalize the levels. An oval shape is imparted to the vault by radiating the bricks, the wide joints so produced being filled with chips of limestone and mud. The upper 5-6 courses are mud-plastered on the exterior and are covered by the fill of the pit. Below the vault is a chamber lined with six courses of headers in X1 bonding, upon which the corbelling rests.

135. Reisner, G.A., *op. cit.*, 251.

136. *ibid.*, 252 and Pls. 30-1.

137. *ibid.*, 253, 255 and Pl. 31.

138. *ibid.*, 255.

139. *ibid.*, 257.

140. Reisner, G.A., *op. cit.*, 263 and Pls. 29-30.

Fig.19 Sections of N.781 and N.787

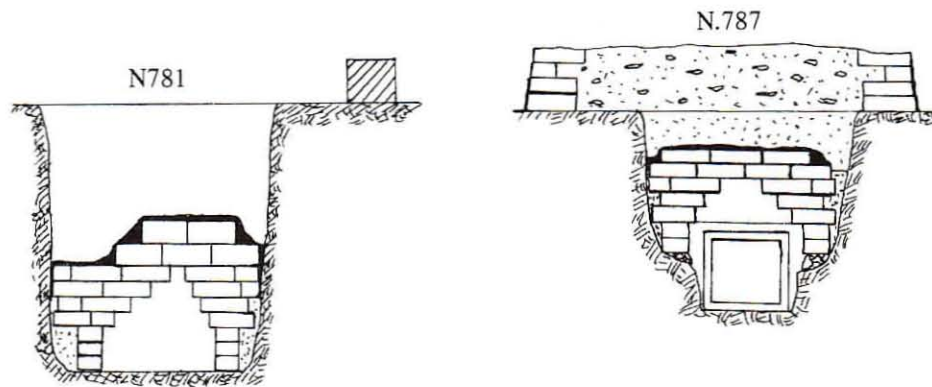
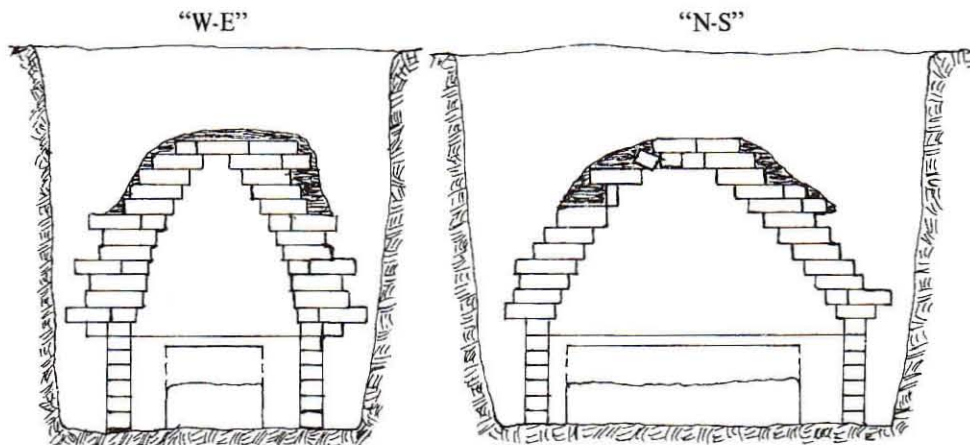
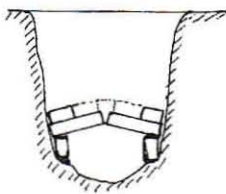


Fig.20 Sections of N.985.



Some of the tombs at Naga ed-Der in the Fourth and Fifth Dynasties replace the corbelling seen in the examples described above by true vaulting. This occurs in N.578-9, 790, 792 and 994. The form of the vault in N.790 is not known since it had collapsed, but the excavators surmised that it had consisted of stretchers (i.e. type x1).¹⁴¹ The vault of N.792 was rather irregular; it used two stretchers combined with two bricks on edge to fill up the space.¹⁴² Over the arched roof

Fig.21 Section of N.994

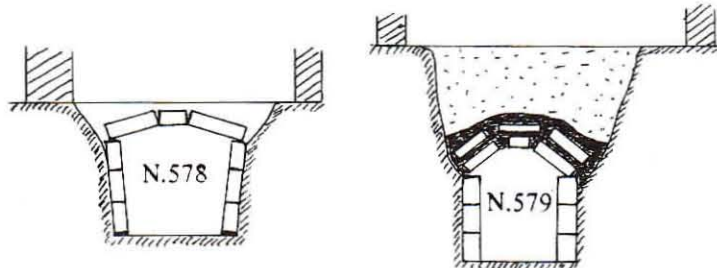


was a coating of mud. In grave 994, the vault had been of two courses, resting on a single layer of brick on edge as a springing.¹⁴³ If the headers of the upper course went right across, then this would be an example of type bx1(1.0).

The tombs N.578-9 have rather better-built vaults than the above examples.¹⁴⁴ Around the pit was a lining, formed in both cases of three courses of brick laid as stretchers on edge, upon which the vaulting rested. The arch in N.578 consists of two stretchers and a central header, as shown in Fig.22. In N.579 the construction is the same, with the addition of a second course of brick, entirely stretchers, above the first.

All the bricked tombs described here from Naga ed-Der belong to the Fourth to Fifth Dynasties. After the Fifth Dynasty the use of brick in the tomb diminishes and is usually restricted to the blocking of the burial chambers.

Fig.22 Sections of N.578 and N.579.



141. Reisner, G.A., *op. cit.*, 257.

142. *ibid.*, 258.

143. *ibid.*, 264.

144. *ibid.*, 222.

Dendera

A number of brick mastabas were excavated at this site by Petrie¹⁴⁵ but the information concerning the brickwork is limited. The only points described are the use of an arched tunnel in the tomb of Adu I and the presence of a dome in that of Merra. The arched tunnel was used as the passage to the burial pit, and is present in other Sixth Dynasty mastabas at Dendera and elsewhere.¹⁴⁶ In the example found in the tomb of Adu I, the tunnel is roofed with a d1 vault in the internal part, with an arch of type c1 at each end. Petrie says that the arch is four courses thick, although the drawing¹⁴⁷ only shows three.

The dome in the tomb of Merra,¹⁴⁸ built over a shaft, is not a true dome, but rather a circular corbel-vault consisting of superimposed rings of stretchers of decreasing diameter. Most of the weight of each course rests on the bricks below it, and even at the apex the dome was not truly vaulted. This technique recurs in brick pyramidal tombs of the New Kingdom.

Edfu.

M.I.

This tomb, belonging to a person called Sabni, is a brick mastaba containing vaulted rooms in the superstructure.¹⁴⁹ The exterior has a slight batter produced by stepping back the courses of bricks a little, and the walls are covered with whitened mud-plaster. The bonding on the faces of the walls shows alternate layers of headers and stretchers, which almost certainly means that the bond used is A2 or A3 as in most mastabas of this period. Vaults formed of inclined courses of bricks (type d1) are used over the rooms in the superstructure, and the bricks throughout the tomb measure 30 x 15 x 8cm.¹⁵⁰

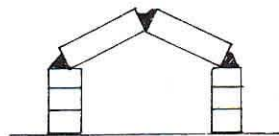
There are several other mastabas at Edfu which belong to the Sixth Dynasty,¹⁵¹ as does the preceding example, but they are so similar to the tomb of Sabni that individual description is not necessary. The main points about their structure are given in the summary table on page 37. A few interesting differences are found in some of the tombs, such as the arched doorway at the entrance to the burial chamber of mastaba C.I. The arch is bonded c1 and is three courses in thickness.¹⁵² The gable-roofed brick coffin built around the body in tomb NO XXVI, of the Fifth Dynasty, is also worthy of note. (See Fig. 23) Similar to this tomb is the burial under a corbel-vault in NO III,¹⁵⁴ which resembles examples of the same form at Naga ed-Der and Tura. The corbelling of the bricks takes four courses to join above the grave, and mud-plaster consolidates the outer surfaces.

Qau, Matmar and Smaller Cemeteries.

At a number of sites there are remains of brickwork in the substructures of tombs and small graves, where all trace of the mastabas which once stood over them have vanished. The use of brick in these graves is therefore confined to the various methods of covering the burial pit, and the most comprehensive series of bricked graves occurs at Qau. Brunton divided the tombs into types,¹⁵⁵ of which numbers 6 to 11 are from the bricked pits, and these are shown in Fig. 24. Very many of these types of graves were found at Qau, beginning in the Fourth Dynasty, becoming common in the Fifth, and practically dying out in the Sixth. After this date brick is used only for the blocking of the burial chamber. Types 9 and 9A occur at Matmar¹⁵⁶ and Mostagedda,¹⁵⁷ and at the former site there is also a new type using a vault of fd1 form over the burial.¹⁵⁸ Type 10 is found at Matmar but not at Mostagedda, and 9 occurs at Armant.¹⁵⁹

Nine graves from Abydos¹⁶⁰ had a rough brick covering over the burial, in most cases built as a corbelled structure against the side of the pit. This is probably to be regarded as the antecedent of Brunton's type 7, which replaces the corbel by a half arch.

Fig. 23 Section of Tomb NO XXVI at Edfu.



145. Petrie, W.M.F., *Denderah, passim*.

146. E.g. the tomb of Haistef at Saqqara, above, page 27.

147. Petrie, *op.cit.*, 9 and Frontispiece.

148. *ibid.*, 15.

149. Michalowski, K., *Tell Edfou*, I (1937), 25-33.

150. Michalowski, K., *op. cit.*, 26.

151. *ibid.*, 25-58, & III, 1-60.

152. *ibid.*, II (1938), 177-80.

153. *ibid.*, III (1939), 7-9.

154. *ibid.*, III (1939), 31-2, & fig. 17.

155. Brunton, G., *Qau and Badari*, I, Pl. XXIV.

156. Brunton, G., *Matmar*, Tomb Registers.

157. Brunton, G., *Mostagedda*, Pl. LXIII.

158. Brunton, G., *Matmar*, Pl. XIX.

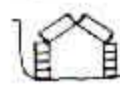
159. Mond, R. and Myers, O.H., *Cemeteries of Armant*, 20.

160. Peet, T.E. and Loat, W.L.S., *Cemeteries of Abydos*, III, 12-4.

The tomb registers published in *Qau and Badari I-III*, *Matmar*, and *Mostagedda* contain a great number of brick sizes taken from the graves in these cemeteries. These measurements are discussed and analysed in Chapter 16.

The chart below contains a synthesis of the major features of brick architecture in the funerary monuments of the Old Kingdom and First Intermediate Period. Some information from small cemeteries which have not been discussed in the text is included here.

Fig. 24 Tomb Types at Qau.

Type.	Section.	Description.
6		Gabled covering built on floor of pit.
7		Half-arch of x1 type.
8		Flat roof of brick and walls of stretchers.
9		x1 vault over low side-walls of stretchers.
9A		Gabled roof built on side-walls.
10		Semicircular x1 vault.
11		Semicircular c1 arch.

SUMMARY, FOURTH - TENTH DYNASTIES.

Location	Bonds Used	Brick Sizes(cm)	Notes
<i>Giza:</i>			
2081		36 x 18 x 11.5	Yellow plaster.
2086	A1	26 x 12 x 8.5	Casing of brick.
2093	A1 A2	37 x 18 x 13 42 x 21 x 15	
2096	A1 A2	40 x 17 x 15 32 x 18 x 11.5	Yellow plaster.
2097		35 x 17 x 12	
2098	A1	24 x 12 x 11	Special bricks for vault.
3033	A1	29 x 15 x 9 38 x 19 x 17	Interlocking bricks for vault
G1203	d1	—	Brick chapel.
Seneb	c1	24 x 13 x 7.5 30 x 10 x 7	Dome roof over one room.
Irti	c1 d1	—	Flat arch used to support vaults.
Meni	A2 A3 c1	—	Arch with moulded edge, red painted.
Akhethotep	—	25-8 x 12-4 x 7-10	Vaulted corridor.
Neferi	A2 c1	30-1 x 13 x 9-10	Arch of special bricks. Dome roof.
<i>Tura:</i>			
10.p.5	X1	—	Corbel of headers.
27.v.1	X1	—	Corbel of headers.

Location	Bonds Used	Brick Sizes(cm)	Notes
<i>Abusir:</i>			
Djadjaemankh	A3	32 x 15 x 9.5	Brick casing.
Userkaf-ankh	—	30 x 13 x 9	
Princesses tombs		32 x 15 x 9.5	
Small VIth Dyn. graves	c1 d1	26 x 13 x 7	
<i>N. Saqqara:</i>			
(Teti area)			
Khui	d1	26.5 x 13 x 7	<i>Tafl</i> bricks.
Desi	A1 cd1	22.4 x 12 x 8	Fake bonding in plaster.
Meru	A2	28 x 14 x 8	
Mastaba A	A2 A3	27 x 13 x 7	
Mastaba E	A2 A3	27 x 13 x 7	
Kaemsenu	—	35-6 x 17-9 x 11-2	<i>Tafl</i> mortar.
Kaemheset	—	52 x 25 x 20	
		53 x 53 x 23	Square bricks for pillars.
Anonymous tomb			
N. of last	A2 A3	52-3 x 26 x 19	
(Unas area)			
Haishtef	A2 A3	31 x 15.5 x 8	Arches of type cl.
Impi	A1	32-3 x 16 x 11	<i>Tafl</i> mortar.
Mehu	A2	30-1 x 14.5 x 9	Bricks on E. of tomb.
Ka-irer	A1 & irreg.	27 x 13 x 8	
Peh-nefer	A2 A3	28 x 14.5 x 10	<i>Tafl</i> mortar.
Adjoining last	A2 A3	24 x 12 x 8.5	<i>Tafl</i> bricks. d1 vault over room.
Re-Khuf	A2 A3	33 x 16 x 11	
(Elsewhere)			
Sobkemiahent	A1 A2	33 x 16 x 12	<i>Tafl</i> bricks. c1 & d1 vaults.
Kaemheset	A2 A3	34 x 16 x 12	Brick casing.
2 Tombs N.E. of Ptahhotep	A3	31 x 15 x 12	White-plastered faces.
		29.5 x 14 x 10	
<i>S. Saqqara:</i>			
Rokhu	c1	—	Arch 4.0 thick.
Nenki	c1	—	Arch 3.0 thick.
M.III	cd1	—	Relieving arch over chamber.
M.V.	d1	—	Vaulted chambers.
M.VI	c1	—	Vaulted 3.0 thick.
M.VII	—	—	Arched roofs.
M.X.	c1	—	Vault 4.0 thick.
N.cemetery.	—	—	c1 , cx1 vaults common.
<i>Dashur:</i>			
Cem. N. of pyr. of Amenemhat II	—	—	General use of vaults.
Cem. S. of pyr. of Sesostri III	—	—	Vaults & arches, c2 in tomb 7.
<i>Meydum:</i>			
16	—	23.5 x 11.5 x 7.5— 24 x 12 x 8	
17	—	39.5 x 18.5 x 12.5— 41 x 22 x 13	
<i>Kafr Ammar:</i>			
O.K. cem.	—	26 x 12 x 8 29 x 14 x 9 32.5 x 16 x 9	Average figures. Average figures. Average figures.

Location	Bonds Used	Brick Sizes (cm)	Notes
<i>Gurob:</i>			
167	—	23 x 11.5 x 7.5	
369	—	29 x 14.5 x 8	Brick coffin.
517	—	28 x 14 x 7.5	Brick lined.
<i>Sedment:</i>			
1253	—	35.5 x 18 x 7.5	
1255	—	35.5 x 18 x 9	
1257	—	33 x 16.5 x 6.5	
1261	—	37 x 16.5 x 7.5	
<i>Dara:</i>			
M	cl cx2	30 x 15 x 8	Many arches & vaults.
P	cl d1	30 x 15 x 8	
<i>Qau:</i>			
678	x1	29 x 14.5 x 6.5	Tomb type 7 (See page 33)
1123	gabled	33 x 18 x 6.5	Type 6
3125	X1	32 x 15 x 7.5	Type 8
1105	X1, x1	33 x 16.5 x 7.5	Type 9
1141	X1, x1	33 x 15 x 7.5	Type 9
1142	X1, x1	33 x 15 x 6.5	Type 9
1145	X1, x1	32 x 15 x 7.5	Type 9
1164	X1, x1	33 x 15 x 10	Type 9
915	gabled	32 x 15 x 7.5	Type 9A
984	gabled	33 x 15 x 6.5	Type 9A
1090	gabled	33 x 16.5 x 6.5	Type 9A
1150	gabled	30.5 x 15 x 7.5	Type 9A
611	x1	30.5 x 16.5 x 6.5	Type 10
1102	x1	33 x 16.5 x 7.5	Type 10
532	x1	32 x 14 x 7.5	Type 10
654	cl	33 x 15 x 10	Type 11
3105	cl	29 x 15 x 6.5	Type 11
1602	—	28 x 14 x 7.5	First Intermediate graves: brick blocking of the burial chamber.
1044	—	32 x 15 x 7.5	
1658	—	32 x 15 x 6.5	
3422	—	29 x 14 x 6	
4815	—	30.5 x 14 x 5	
4822	—	30.5 x 15 x 9	
7514	—	33 x 15 x 9	
7563	—	30.5 x 16 x 9	
4981	—	33 x 18 x 7.5	
<i>Matmar:</i>			
830	x1	32 x 15 x 7	Type 9
839	x1	30 x 15 x 6	Type 9
849	x1	32.5 x 15 x 7	Type 9
850	x1	31 x 15 x 7.5	Type 9
856	gabled	—	Type 9A
865	gabled	33 x 17 x 7.5	Type 9A
415	—	31 x 15 x 6	
427	—	30 x 14 x 5	
575	—	31 x 14 x 6	First Intermediate Period bricked graves.
632	—	32 x 16 x 6	
3042	—	31 x 15.5 x 6.5	
5309	—	31 x 14.5 x 7	

Location	Bonds Used	Brick Sizes(cm)	Notes
<i>Mostagedda:</i>			
532	gabled	—	
689	X1, x1	31.5 x 15.5 x 9	Type 9.
<i>Naga ed-Der:</i>			
N.645	X1	—	Corbel of headers.
N.760	X1	—	Corbel of headers.
N.771	—	—	Circular corbel.
N.781	X1	—	Corbel of headers.
N.787	—	—	Corbel of headers.
N.791	X1	—	Corbel of headers.
N.985	X1	26-8 x 11.5 x 7-8	Corbelled.
N.792	A1 A8	—	Vault in pit.
N.994	bx1(?)	—	Arched pit.
N.578	Irreg.	—	Arched pit.
N.579	Irreg.	—	Arched pit.
N.739	A1 A2	—	
N.788	X1	—	
N.720	A1	30 x 15 x 8	Door blocking.
N.893	—	32 x 10 x 10 28 x 13 x 7	Retaining edge of shaft.
<i>Reqaqnah:</i>			
R.59	—	—	Circular corbel.
R.251	—	—	Circular corbel.
R.56	—	—	Corbel of headers.
R.66	—	—	Flat brick roof.
R.80	—	—	d1 vault used.
R.110	cx1	—	Vault 1.0 thick.
<i>Abydos:</i>			
910	—	28 x 13 x 7.5	Serdab roofed by dome. Vth Dyn.
D117	}	—	Bricked pits:— corbels and small vaults.
D118			
D125			
D130			
D147			
D149			
D182			
D184	}	—	
D253			
<i>Dendera:</i>			
Merra	—	—	Dome over shaft.
Adu I	cl	—	Arched tunnel.
<i>Armant:</i>			
1310	cl	29.5 x 14.5 x 10 25 x 11.5 x 9	Arched over.
1323	—	35 x 15 x 9 28 x 14 x 7	
1330		25 x 12 x 7 35 x 17 x 6 30 x 15 x 10 (vault) 29 x 13 x 8 26 x 13 x 8 34 x 12 x 6	
1354			
<i>Edfu:</i>			
M.I	A1 d1	30 x 15 x 8	White plastered.
M.II	A1 d1	—	

Location	Bonds used	Brick sizes (cm)	Notes
M.IV	A1	30 x 14 x 8	
M.VI	A1	—	Pointed vault.
M.VII	Irreg.	32 x 15 x 8	
M.VIII	—	30 x 15 x 7	Yellow plaster.
M.IX	A1	30 x 14 x 10	
M.X	—	30 x 15 x 10	
C.I	A1 c1	—	Arched door.
NO.XXVI	A1	30 x 11 x 8	Brick coffin.
NO.II	A1	—	Sand-fill mastaba.
NO.III	—	—	Corbel of headers.

7. Royal Pyramids of the Middle Kingdom.

The funerary monuments of the earlier kings of the Eleventh Dynasty at Thebes had brick pyramidal superstructures of modest proportions, that of Inyotef II being about 15 metres square.¹⁶¹ These tombs are mentioned in the Abbott Papyrus as having been inspected in the Twentieth Dynasty, and the description given confirms them to have been pyramidal tombs. Mariette discovered the pyramid of Inyotef II, but it was destroyed to its foundations and no details of the brickwork are available.

In the later Eleventh Dynasty, stone was used to build the royal tombs, the most famous example being the temple of Mentuhotep II at Deir el-Bahari. This great monument contained two tombs, one behind the pyramid and another in the courtyard (the Bab el-Hosan), the latter being blocked with bricks measuring 37 x 17 x 12cm.

Fortunately, much more remains of the pyramids of the Twelfth Dynasty. Those belonging to Amenemhat I and Sesostri I at Lisht, and Amenemhat II at Dashur, were constructed of stone and therefore are not included in this survey, but the constructional details of the brick pyramids are given below.

Sesostri II (Lahun). ¹⁶²

The pyramid is constructed of bricks measuring 45-9 x 22-5 x 19cm,¹⁶³ which are all laid perpendicular with respect to the nearest face of the pyramid. Walls of limestone run through the diagonals of the structure, with cross-walls between them, thereby dividing up the area into separate compartments in which the bricks were placed, and a casing of limestone originally covered the surfaces of the brickwork. (See Fig. 25, p.38) Around the pyramid is an enclosing wall, built in A2 or A3 bonding, with layers of reeds between every fourth course of bricks. The dimensions of the bricks in this wall are the same as those of the pyramid itself.

Sesostri III (Dashur). ¹⁶⁴

A calculation of the volume of this pyramid leads to the result that 24½ million bricks would have been used in its construction.¹⁶⁵ The average size of these bricks is 42 x 21 x 11.5cm but variations occur from 39 x 19.5 x 11cm to 43 x 22 x 15cm. They are laid in even rows of headers without any bonding, and with only a layer of sand between the courses. The stone casing of the pyramid rested partly on the previous course of casing-blocks and partly on the brickwork, which was built up in steps behind the limestone. (See Fig. 26) It seems most likely that the course of stone blocks was laid first, then the brickwork built up inside it to the same level, followed by the laying of the next course of stone, and so on, until the structure was complete. Some of the bricks bore marks similar to the quarry marks seen on the masonry of stone pyramids, and De Morgan suggested that the marks denoted the products of different royal brickyards.¹⁶⁶

To the South of the pyramid enclosure there was a boat grave in a large trench in the ground. This trench was covered over by a d1 vault, ten courses thick, with the inclined rings of brickwork resting on the end wall of the trench.

Sesostri III had another tomb at Abydos, cut into the rock. The brick-built temple of this monument is described in Chapter Five.

161. Edwards, I.E.S., *The Pyramids of Egypt*, 212.

162. Petrie, W.M.F., *Lahun II*, *passim*.

163. Approx. dimensions, from scale drawing.

164. De Morgan, J., *Fouilles à Dachour*, Mars-Juin 1894, 47-50.

165. *ibid.*, 47.

166. *ibid.*, 49.

Fig.25 Structure of the Pyramid of Sesostris II.

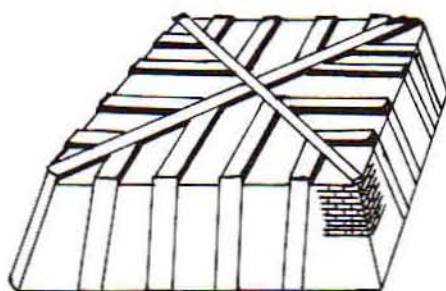
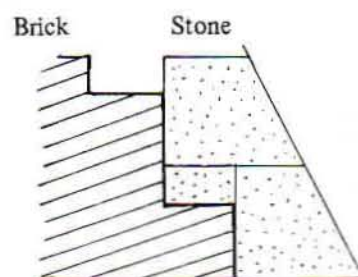


Fig.26 Section of Casing, Pyramid of Sesostris III.



Amenemhat III (Dashur).

De Morgan states that this pyramid had the same basic construction as that of Sesostris III, but he gives no detail. The sizes of the bricks are given in Mariette's *Les Mastabas de L'Ancien Empire*¹⁶⁸ as having a fair amount of variation, the examples being: 33 x 18 x 11cm, 38 x 19 x 12cm, 35 x 17 x 11cm and 40 x 20 x 10cm.

Amenemhat III (Hawara).

The bricks of the pyramid are 45 x 22.5 x 13.5cm in size, and were laid in sand in most of the structure. Prior to the building of the pyramid, they had been splashed with a yellow wash whilst stacked, to prevent any being stolen.

A great arch was built above the roof of the burial chamber, through the mass of the pyramid, to relieve the weight on the stone roof. This arch consisted of five courses of bricks and was of type cx2. Below the arch the bricks were no longer laid in sand, but had mud mortar in the horizontal joints. Petrie points out that the weight of bricks of the size used here is 40–50 pounds,¹⁷⁰ which means that they must have been set into place fairly slowly and carefully.

Neferuptah (Hawara).

Since Petrie found a sarcophagus and an offering-table inscribed for Neferuptah¹⁷¹ in the pyramid of Amenemhat III, it has been assumed that she was buried in her father's tomb. But recently a separate pyramid has been discovered belonging to this princess, not far from that of Amenemhat III at Hawara.¹⁷² The only detail recorded about the brickwork of this structure is the size of brick employed, being 46 x 24 x 14cm.¹⁷³

The Pyramids of Mazghuneh.

The two pyramids of Mazghuneh are so similar in construction to that of Hawara that Mackay ascribed them to Amenemhat IV and Queen Sebekneferu on this evidence alone.¹⁷⁴ At the North pyramid the superstructure has entirely vanished, and the only brickwork of note is a retaining wall around the site, consisting of two thin walls of A1 bonding with rubble filling between them to form a single thick wall.

The South pyramid was built of bricks measuring 46.5 x 23.5 x 12.5cm, laid as headers from the faces with sand in the joints. Around the pyramid is a wall built on a serpentine plan,¹⁷⁵ formed almost entirely of stretchers, whose dimensions range from 30.5 x 15.5 x 9.5cm. to 32.5 x 17 x 10.5cm. The thickness of this wall at its base is only 41.5cm.

Most of the royal tombs of the Thirteenth Dynasty are as yet unaccounted for, but two pyramids of this age were discovered at Saqqara by Jéquier.¹⁷⁶ One of these belongs to king User-ka-re Khendjer, but the identity of the owner of the other pyramid is unknown.

167. De Morgan, *op. cit.*, 87.

168. Mariette, A., *Les mastabas de l'Ancien Empire*, 571.

169. Petrie, W.M.F., *Kahun, Gurob and Hawara*, 14.

170. *ibid.*, 6.

171. *ibid.*, 15 & Pl. V.

172. Farag, N., *The Discovery of Neferuptah*.

173. Farag, N., *op. cit.*, 2.

174. Petrie, W.M.F. & Mackay, E., *The Labyrinth, Gizeh & Mazghuneh*.

175. *ibid.*, Pl. XXXIX.

176. Jéquier, G., *Deux Pyramides de Moyen Empire, passim*.

Khendjer.

The pyramid is constructed in the usual manner, with the bricks laid as headers on layers of sand. One brick, found loose, bore an inscription giving a date,¹⁷⁷ just as dates occur on the masonry of the stone pyramids at Saqqara and Dashur. The average size of the bricks is 42 x 21 x 11 cm.

An outer wall of brick, of which no details are given, surrounds the pyramid, and within the enclosed area is another wall, in this case of stone. Near the base of the stone wall Jéquier found traces of a wall of the sinusoidal type,¹⁷⁸ as exists at the Mazghuneh pyramids (See above). This led Jéquier to suggest that the sinusoidal brick wall was built to keep sand off the site during the construction of the burial pit, and was replaced by a more impressive stone wall if time permitted.¹⁷⁹

Unknown Pyramid (S. Saqqara).

The bricks of the pyramid are all laid as headers, and present some variation in size, as the following examples show: 40 x 21 x 12 cm, 44 x 22 x 13 cm, and 42 x 23 x 12 cm.

Above the pointed roof of the burial pit is a brick relieving arch of type c1, four courses thick at its edges and five in the centre.¹⁸⁰

There is a serpentine enclosure wall around the pyramid standing to a height of 2 metres on the North side, and 65 cm thick at its base.¹⁸¹ It is built mostly of stretchers, with headers inserted infrequently at irregular intervals, and the face is coated with mud-plaster. Near the South-East angle there is a stairway to the top of the wall.¹⁸² The bricks are smaller than those of the pyramid, being 34 x 17 x 8 cm to 36 x 18 x 8 cm.

8. Other Brick-Built Tombs of the Middle Kingdom.

There is little material for the study of brick architecture from cemeteries of the Middle Kingdom, partly due to the frequency of rock-cut tombs at this period, and partly to deficiencies in the reporting of excavations. Sites which give only slight information are not discussed here, all the facts available being stated in tabulated form at the end of this section.

Thebes.

In the cliffs around Deir el-Bahari are a number of tombs of the Eleventh Dynasty, having passages and chambers cut into the rock.¹⁸³ The facades, however, were faced with thick masses of brickwork on each side of the entrance, and in some cases brick was used also to line the internal passages. A sloping face was imparted to the facade by stepping back the bricks slightly at each course and then coating the surface with mud plaster to a thickness of 3 cm. This plaster was originally whitened with gypsum. The facade was thus formed of a thick wall of trapezoidal section, with its rear surface against the rock. In most cases this wall is composed entirely of transversely laid headers, so that only the ends of the bricks are visible on the exterior. One tomb, numbered 513,¹⁸⁴ had this mode of construction only in the upper half of the facade, whilst the lower section was built in A1 bonding, thereby reducing the angle of slope of the face. The bricks are usually composed of grey mud, and measure 30–32 x 15–16.5 x 8 cm, although some examples were smaller, for instance in tomb 512, where they range from 28 x 15 x 7.5 cm to 29.5 x 16 x 8.5 cm. Any mortaring of the joints is roughly done, occasionally with mud but more often with *tafl*. Most of these tombs have an approach in front of the facade, flanked by walls of white-plastered brickwork. The bonding of these walls is nearly always A1, but in a few cases A2 occurs. In areas where the rock was of poor quality and liable to crack, the passage of the tomb was reinforced by a lining formed of a brick vault of type d1 a single course in thickness.¹⁸⁵

It is in these Eleventh Dynasty tombs that funerary cones first appear, used in a single or double row over the facade. These cones have no inscriptions but are a purely decorative special form of burnt brick. The most plausible suggestion as to their origin is that they represent the ends of the roofing-logs of an Egyptian house,¹⁸⁶ a theory

177. *ibid.*, 29.

178. *ibid.*, PLIV.

179. Jéquier, G., *op. cit.*, 56.

180. *ibid.*, 65 & Pl. XVIII

181. *ibid.*, 56.

182. *ibid.*, 56.

183. *PM* I, part II, 650 and Plan V. Also *BMMA* XVIII (Dec. 1923, II), 11–20.

184. Winlock's numbering, = 314 of *PM*.

185. Example occurs in tomb 512 of Winlock.

186. Winlock, *BMMA* XXII (Feb. 1928, II), 7.

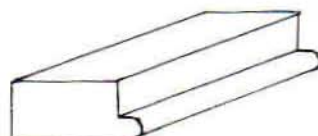
which is supported by the depiction of roofing-beams carved in stone over the entrance to the tomb of Khnumhotep II at Beni Hasan.¹⁸⁷

Further tombs of the Eleventh Dynasty occur on the lower ground in Asasif, a recently discovered example being the tomb of a certain Inyotef, which lay beneath the causeway of the temple of Tuthmosis III in Deir el-Bahari.¹⁸⁸ Details of the brick construction of this tomb are given in the table on page 42.

Qattah.

This cemetery has brick-built tombs with vaulted chambers sunk into the ground until the roof is just under the surface.¹⁸⁹ The vertical walls built around the sides of the chambers are bonded A1 or A2, and the mud-bricks, in all except tombs 2 and 11, measure 25 x 15 x 12cm. In number 11 they reach 44 x 22 x 14cm, whilst the size of bricks in the vaulting of tomb 2 is not stated.¹⁹⁰ One unusual brick was found in tomb 9 with a moulding down one edge; perhaps it was a re-used brick from a cornice.¹⁹¹

Fig. 27 Special brick from Tomb 9 at Qattah.



Since drawings of all the vaults are not given in the report it is difficult in some cases to be absolutely sure of their constructional details. The list below states the types of vaulting used in each tomb, and where the photographs do not show sufficient detail the entries are marked with a query:

Tomb.	Burial Chambers: Vaults.	Arches over doorways.
1	bd1(2.0), d1(1.5)	c1(1.5)
2	cd1(6.0)	(?)
3	d1(?)	(?)
4	d1(0.5)?	(?)
10	(?)	c1(2.5)
11	d1 or c1	c1(2.5)
12	(?)(2.0)	(?)
14	c1	(?)

The tombs 5, 6 and 8, absent from the above list, were simple pits devoid of any brickwork.¹⁹² It can be seen that the inclined vault (type d1) is common over fairly wide spans, sometimes in conjunction with an upper course of brick laid differently. In these cases the inclined first course, which itself was built without centring, would act as a centring for the ring of bricks laid over it. In all the vaults a coat of mud plaster covered the interior surface of the brickwork.

Abusir.

A number of Middle Kingdom graves were built around the mortuary temple of the pyramid of Neuserre, most of them being stone tombs with brick approaches.¹⁹³ A few (for example, mR.20) had vaulted burial chambers, the roofs being inclined vaults of type d1, one course thick, with stones used to fill the gaps between the bricks. As an example of the brick sizes used in the cemetery, the measurements 28.5 x 14 x 9cm and 38 x 19 x 12.5cm may be quoted from tomb mR.1.¹⁹⁴

187. Newberry, P.E., *Beni Hasan*, I, Pl. XXII.

188. Arnold, D., *Das Grab des Injyt, f: die Architektur*.

189. Gauthier, H. et al., *Fouilles de Qattah*, *passim*.

190. *ibid.*, 8.

191. *ibid.*, 27.

192. Gauthier, H., et al., *Fouilles de Qattah*, 23.

193. Schäfer, H., *Priestergräber vom Totentempel des Neuserre*, 15ff.

194. *ibid.*, 19.

Dashur.

The group of Twelfth Dynasty mastabas which lie to the North of the pyramid of Sesostri III seem to have used brick vaults for the roofing of the passages to the burial chambers. In only one case is the brickwork reported in any detail: ¹⁹⁵ tomb 17 had a corridor roofed by a vault of type d1, which rested at its end on an arch of rather irregular construction, the bricks being laid mostly on edge except for one laid flat across the apex. ¹⁹⁶

Riqqeh.

Bricks were used at Riqqeh mainly for retaining the sides of shafts or descents to the tombs, the chambers themselves being either stone-built or cut into the rock. The builders had much trouble with veins of loose sand in the rock which had to be held back by brickwork. Engelbach gives a vivid description of one of these retaining walls being pushed over by the pressure of the sand, ¹⁹⁷ and suggests that three enormous bricks found in Pit 305 may have been made as an experiment to see whether it was possible to hold back the flow. The bricks in question measured 71 x 35.5 x 30cm and must have weighed well over a hundredweight each. A more normal example of the brick sizes in use in the cemetery is 45.5 x 23 x 15cm in tomb 300. ¹⁹⁸ Some of the shafts at Riqqeh were found to be capped over with a brick dome or circular corbel, whilst one example had a vault. ¹⁹⁹ The purpose of this is not clear, but it may have been for security from thieves, or connected with the problem of the loose sand.

Abydos.

Despite the great amount of excavation which has taken place at this site there is a lack of information about the tomb construction, especially for the Middle Kingdom monuments. The large vaulted tombs which Mariette restored with pyramidal superstructures he dated to this period, but an examination of the results of later excavations shows that he was mistaken. The type of tomb shown on Plates 66-67 of Mariette's *Abydos II* is of a style belonging to the Twenty-Sixth to Thirtieth Dynasties, and the typical Middle Kingdom tomb was different, with burial chambers at the bottom of a shallow shaft, and a small mastaba on the surface. ²⁰⁰ A few details of the construction of these mastabas can be given. They were usually square, with a slight batter on the face, and had small offering chambers within them. In most cases the roofing of this chamber has gone, but there is one instance of the use of a vault and another which may have been corbelled. ²⁰¹ In mastaba N, found by Peet, ²⁰² the entrance was by means of an arched passage of type c1, and probably this was generally used. The above information is derived from Cemetery S of Peet, in which the best-preserved mastabas were found. Tombs of Middle Kingdom date also occur in the North Cemetery, dug by Peet, ²⁰³ and in Cemetery G of Petrie, ²⁰⁴ but their superstructures were denuded and consequently no brickwork is available for study.

Edfu.

The Middle Kingdom tombs at this site make frequent use of the brick vault to cover the burial apartments, and in most cases the chamber is reached by means of an arched doorway from a shallow pit. The arches are universally of the c1 type, one course thick, four examples of this being found in tomb XXV. ²⁰⁵ Above the chambers the vaulting could be either d1, as in tomb X, ²⁰⁶ or cx1, as found in tomb XXVIII-XXIX. ²⁰⁷ A common size for the bricks is 30 x 15 x 7cm, and they were laid with a coating of mud-plaster.

Small graves were also discovered, ²⁰⁸ just long enough for an extended burial, walled around with four courses of stretchers, and covered by an x1 vault of a single course of brick.

195. De Morgan, J., *Fouilles à Dachour*, Mars-Juin 1894, 31-2.

196. *ibid.*, 32, fig.62.

197. Petrie, W.M.F. & Engelbach, R., *Riqqeh and Memphis VI*, 2.

198. *ibid.*, 4.

199. *ibid.*, 7-8.

200. Peet, T.E., *Cemeteries of Abydos*, II, 35ff.

201. *ibid.*, 37.

202. Peet, T.E., *op. cit.*, 37.

203. *ibid.*, 54.

204. Petrie, W.M.F., *Abydos*, I, 34-40.

205. Michalowski, K., *Tell Edfou*, III (1939), 85-8.

206. *ibid.*, 93-9.

207. *ibid.*, 80-2.

208. *ibid.*, 91.

Kubanieh.

Tombs have been found at the sites of Kubanieh North and South²⁰⁹ which are similar to the type used at Qattah although somewhat smaller. They consist of vaulted structures sunk into the ground, with brick side-walls and roofing. The vaults here are built of one or two courses of brick in x1 bonding and the side-walls are usually a single brick-length in thickness. As the width of the graves is only one or two metres the thin vaults are quite adequate. At Kubanieh North the size of the bricks was 30-3 x 15-6 x 5.5-7.5cm,²¹⁰ whilst at the Southern site they varied from 31 x 13 x 9cm to 35 x 17 x 10cm.²¹¹

SUMMARY: MIDDLE KINGDOM TOMBS.

Location	Bonds Used	Brick Sizes(cm)	Notes
<i>Thebes:</i>			
512 ²¹²	A1	28-29.5 x 15-6 x 7.5-8.5	Facade all headers.
513	A1	30-2 x 15-16.5 x 8	Taftl mortar.
514	A1	30-2 x 15-6 x 8	Facade all headers.
Inyotef ²¹³	A2 A3	31-2 x 15.5-16.5 x 5.5-7 35-6 x 16-8 x 8.5-10.5	
<i>Bubastis:</i>	Cemetery of brick vaulted tombs enclosed by a wall. (Details not available)		
<i>Abusir:</i>			
mR1	—	28.5 x 14 x 9	Bricks laid in mud mortar.
mR.20	d1	38 x 19 x 12.5	Vaulted chamber.
<i>Saqqara:</i>			
Gemniemhet	A1	40 x 20 x 15	Brick blocking.
17 ²¹⁴	cx2	—	Arch roof, 9 courses thick.
91	—	22 x 11 x 7	Lined shaft.
<i>Dashur:</i>			
17	d1	—	Vaulted passage.
<i>Riqqeh:</i>			
300	—	45.5 x 23 x 15	
305	—	71 x 35.5 x 30.5	Exceptional bricks.
<i>Lahun:</i>			
608	—	36 x 18 x 9	
905	—	39.5 x 20 x 11.5	
<i>Harageh:</i>			
6	—	33 x 16.5 x 9	
13	—	33 x 16.5 x 10	
172	—	40.5 x 20.5 x 15	
<i>Abydos:</i>			
Mastaba N	A1 c1	—	Arched passage and domed room.
<i>El-Kab:</i>	Cemetery of brick vaulted tombs, using x1 vaults. ²¹⁵		
<i>Edfu:</i>			
X	d1	30 x 15 x 7	Vaulted chambers.
XXV	c1	—	4 doors with c1 arches.
XXVIII-XXIX	X1 , cx1 c1 , d1	30 x 15 x 7	Vaulted chambers.
<i>Kubanieh:</i>			
(North)			
19.f.6	Irreg.	30 x 15 x 5.5	Nubian M.K.
21.f.2	d1	—	Vaulted chamber.
20.g.1	X1 , A1 , d1	—	Vaulted chamber.
11.k.2	Irreg.	30 x 15 x 7	Egyptian M.K.
14.l.1	A1 , x1 , c1	—	Vaulted chamber.

209. Junker, H., *Friedhofen von el-Kubanieh Nord, and Sud.*

210. Junker, H., *Friedhofen von el-Kubanieh Nord*, 47-50 and 153-60.

211. Junker, H., *Friedhofen von el-Kubanieh Sud*, 166-9.

212. Winlock's numbering.

213. Arnold, D., *Das Grab des Injft. f: die Architektur.*

214. Excavated by Quibell, East of Teti Pyramid

215. See *CdE* 45 (1970), 40-44.

Location	Bonds used	Brick sizes (cm)	Notes
(South)			
23.r.1	A1 , X1 , x1	—	Vaulted chamber.
28.q.2	X1 , x1	35 x 17 x 10 31 x 13 x 9	Vault 1.38m high.
24.t.6	A1 , X1 , x1	32 x 16 x 9	Vaulted chamber.
24.t.1	A1	28 x 15 x 9 27 x 16 x 8	Brick-lined pit.

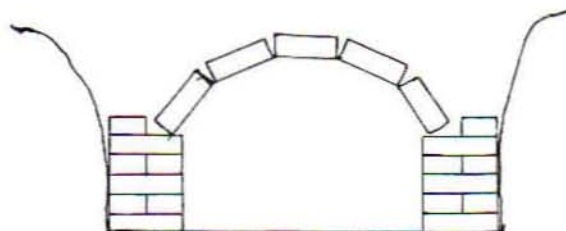
9. The Second Intermediate Period.

Most branches of Egyptology lack information about this period, and brick architecture is no exception. Such facts as can be assembled from individual sites are given here, and a few more details are added in the table on page 44.

Tell Da'ba.

A number of small graves of Hyksos date have been discovered at this site, consisting of x1 vaults sprung from low side-walls built in A1 bonding.²¹⁶

Fig. 28 Tell Da'ba grave.



Dashur.

In the peribolos of the pyramid of Amenemhat III a deep pit was found²¹⁷ containing the tomb of king *ḥw-ḥb-rꜥ* Hor, whose position in history has been disputed. Probably he is the seventh king of the Thirteenth Dynasty, named *ḥw-ḥb-rꜥ* in the Turin Canon. The fact that seals of Amenemhat III were found on some of his funerary equipment²¹⁸ does not date the burial to the Twelfth Dynasty, as the priests of the pyramid complex would continue to use these seals long after the death of Amenemhat III. Unfortunately, De Morgan gives no details of the bricks in this tomb, so it is not possible to see whether these are the same or different from those of the pyramid of Amenemhat III. The interest of the tomb, from the structural viewpoint, centres on the arches which are used over the chambers. One of these is of type x1, whilst another is of the uncommon type f1. The latter is used as a relieving arch to take the weight off a stone lintel. Another arch of the same form occurs in a wall of brick about half-way down the shaft.²¹⁹

Sedment.

In the Second Intermediate Period graves brick is used for lining the pits or making brick coffins with vaulted tops, similar to the type used in the Fifth Dynasty at Qau.²²⁰ (See above, page 33, type 9A) The brick sizes at Sedment form a fairly close group, ranging from 34.5 x 16.5 x 7.5cm to 38 x 18 x 10cm.²²¹

216. Bietak, M., *MDIK*, 23, (1968), 90-99 and Pl.XXV.

217. De Morgan, J., *Fouilles à Dachour, Mars-Juin, 1894*, 88-9.

218. *ibid.*, 105.

219. *ibid.*, 89.

220. Petrie, W.M.F., *Sedment*, 1, 16-7.

221. *ibid.*, 15-9.

Edfu.

Three tombs of the early Second Intermediate Period at Edfu have vaulted chambers of type x1 but no other details of interest are noted.²²²

Despite the presence of tombs of this age in other cemeteries, such as Esna and Saqqara, virtually no details of the brick construction are available. Some graves at Tell el- Yahudieh²²³ had vaulted brick covering, probably similar to those found more recently at Tell Da'ba, which may mean that this type was not uncommon in the Delta during the Hyksos period.

At Thebes, the tombs of the kings of the Seventeenth Dynasty stood in the Asasif region,²²⁴ but they have been so completely destroyed that their structure cannot be examined. It is known, however, that they had pyramidal superstructures of brick, the construction of which would in all probability have been very similar to the New Kingdom tombs of the same form.²²⁵

SUMMARY – SECOND INTERMEDIATE PERIOD

Location	Bonds Used	Brick Sizes(cm)	Notes
<i>Yadudieh:</i>	x1?	—	Brick vaulted graves.
<i>Tell Da'ba:</i>	x1 , A1		Vaulted graves, of Hyksos date.
<i>Dashur:</i>			
Hor	A1 , x1 f1	—	Unusual type f1 bond in arches.
<i>Sedment:</i>			
1253	—	35.5 x 18 x 8	Bricks used for lining pits and making coffins.
1257	—	33 x 16.5 x 6.5	
1261	—	37 x 16.5 x 7.5	
1274	—	38 x 18 x 10	
1277	—	34.5 x 16.5 x 7.5	
1218	—	37 x 16.5 x 10	
<i>Thebes:</i>	Seventeenth Dynasty brick pyramid-tombs.		
<i>Edfu:</i>			
IV	x1	—	Vaulted chambers.
V	x1	—	
XXVII	x1	—	

10. New Kingdom Tombs.

Nebesheh.

Although the cemetery at this site is mainly of the Late Period, there are also a number of tombs of Ramesside date.²²⁶ These take the form of underground chambers, probably vaulted, reached by means of shallow pits. examples deserve special mention, since they are built entirely of red burnt bricks. One of these, number 35, dates from the Nineteenth Dynasty, whilst the other, numbered 21, belongs to the late Ramesside age.²²⁷ In the latter tomb the bricks measured 34 x 16 x (?)cm and were laid irregularly without mortar.²²⁸

222. Michalowski, K., *Tell Edfou*, II (1938), 195.

223. Petrie, W.M.F., *Hyksos and Israelite Cities*, 10-16.

224. Winlock, H.E., in *JEA* 10 (1924), 217ff.

225. For example, at Dira' abu'l Naga.

226. Petrie, W.M.F., *Nebesheh in Tanis*, II, 18-9.

227. *ibid.*, 19.

228. *ibid.*, 19.

Tell el-Yahudieh.

Graves with brick lining and gable roofs occur at Tell el-Yahudieh in the Twentieth Dynasty, and continue with little alteration down to very late times. (See below, page 53) The New Kingdom graves are walled around with stretchers laid on edge and covered by gabled bricks,²²⁹ as illustrated in Fig. 29. Within this brick structure there is generally a pottery coffin containing the burial.²³⁰ The graves lie beneath tumuli formed of irregular blocks of basalt, a single one of these superstructures sufficing to cover several burials.²³¹ A number of brick measurements from the cemetery are given in the chart on page 48.

Gurob.

A number of graves with bricked substructures have been found in an extensive New Kingdom cemetery,²³² the different forms of brickwork being shown in Figs. 29 and 30. The first type there illustrated is an attempt to reproduce the form of a coffin in brick, with the top covered by a gabled roof. A similar structure is created in type F, with the sides composed of large bricks standing on end, in place of stretchers, and the space above spanned by single bricks laid flat. Types B and D both enclose the burial behind a half arch of brickwork, the bricks being laid as in c1 arches, and covered over with mud. Examples of the brick sizes used in these graves are given in the table on page 48, where they can be seen to form a fairly homogenous group, the large size 38cm in length being the most common.

Fig. 29 Ramesside Grave, Tell el-Yahudieh.

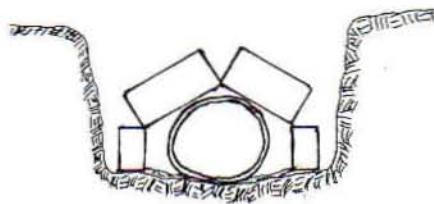
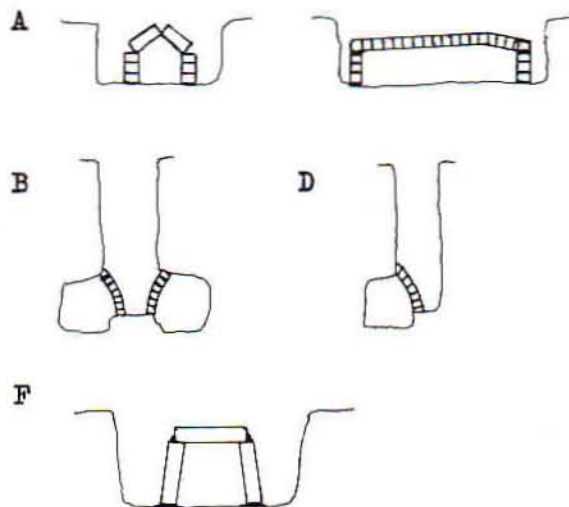


Fig. 30 Types of Graves, Gurob.²³³



Abydos.

The tombs of the Eighteenth Dynasty are beginning to make use of the brick vaulted chamber which is so characteristic of this site in the New Kingdom and later.²³⁴ These burial chambers are constructed in a pit, so that their roof level is just below the ground surface, and entry is gained by means of a shaft about two metres in depth. The doorway from the shaft to the chamber is spanned by an arch of type c1 and the roof of the substructure consists of a vault of stretchers (type x1), usually two or three courses in thickness.²³⁵ Probably there was a mastaba built on the ground surface over the vault, but no preserved examples have yet been found. The use of this type of tomb continues throughout the New Kingdom and develops further in both substructure and superstructure in the Twenty-Second to Thirtieth Dynasties.

229. Griffith, F.L., in Naville, E., *Mound of the Jew*, 42.

230. *ibid.*, 42 & Pl. XIV.

231. *ibid.*, 44.

232. Brunton, G., *Gurob passim*.

233. The types are those of Brunton. See *op. cit.*, Pl. XVIII.

234. Peet, T.E., *Cemeteries of Abydos*, III, Chapter IV.

235. *ibid.*, 29.

Another form of tomb was also used at Abydos in the New Kingdom, having all the appearance of a small temple, with an open forecourt and inner roofed chapels.²³⁶ Like the underground vaulted graves, this type begins in the Eighteenth Dynasty and lasts throughout the Late Period. The actual burial chamber was cut in the gravel and reached by a pit from the chapel. In some examples the roofing of the inner chambers was partially preserved, showing it to have been formed of brick vaults, as in New Kingdom tombs of similar form at Aneiba.²³⁷ Further parallels occur in the mortuary chapels of the Twentieth to Twenty-Fifth Dynasties which stood behind the Ramesseum²³⁸ and the temple of Medinet Habu at Thebes,²³⁹ the latter group being reconstructed by Hölscher with vaulted roofs.²⁴⁰ Consequently, this type of tomb was not restricted to Abydos but was fairly widespread in the New Kingdom, with minor variations from one site to another. The form of the vaulting used in the Abydos tombs could not be discovered due to their poor state of preservation, but it would most probably have been that composed of inclined rings of brickwork, (type d1) since this is the form most commonly employed at this period. At Aneiba this type of bonding was certainly used, since special bricks derived from the roofing were found to measure 42 x 19 x 7cm,²⁴¹ bricks of these proportions being the standard type used in the construction of d1 vaults.

Thebes.

From the structural viewpoint, the most interesting tombs at this great site are those situated in Deir el-Medina and Dira abu'l Naga. Some tombs of Sheikh Abdel Qurna use brickwork for the facade or for making a courtyard outside the entrance, but this brickwork is rarely reported in detail since it has no special points of interest, being constructed in common Class A bonding covered with white plaster. The interest of the tombs of Deir el-Medina and Dira abu'l Naga stems from the use of brick vaults and pyramidal superstructures, and these two groups will now be described separately.

Deir el-Medina.

The small tombs of Deir el-Medina make universal use of the brick vault to roof both the burial chamber and the chapel, these vaults being constructed in either d1 or x1 bonding, the former being more common.²⁴² Where the roof is two courses thick the courses are often inclined in opposite directions, a technique also used at the Ramesseum. Special bricks are employed for the vaults, with a thickness of 5cm and grooves on their faces to provide a better key for the mortar. These bricks are made with one side slightly longer than the other so as to take a wedge-form more suitable for the construction of vaults, and at this site they are always 35 x 15 x 30 x 5cm in size.²⁴³ A number of other specialised forms of brick have been found,²⁴⁴ having been used for cornices in the tombs; these are discussed together with the special bricks from other sites, in Chapter 15.

Borchardt has shown that some of the Deir el-Medina tombs had beams of wood under the vaulting, running both the length and breadth of the roof, and the tomb of a certain Irinefer was provided with a central column of wood to support these beams.²⁴⁵ He sees a symbolic reason for the presence of the roofing beams, derived from the imitation of earlier structures made of wood. This suggestion is proved by the fact that some tombs which have no woodwork imitate its presence in the painted decoration, the broad bands along and across the roof representing the beams.²⁴⁶ However, Borchardt can find no explanation for the presence of the column in the tomb of Iri-Nefer and concludes that it must have had a structural function.²⁴⁷ Such a support is totally unnecessary for a vault of the type used here, and it seems more likely that the woodwork is connected with the Egyptian concept of the tomb as a dwelling-house; the column and beams would be built into the sepulchre to make the resemblance between house and tomb more apparent.

The superstructures of the tombs consisted of small brick pyramids built over a vaulted chapel, in front of which was a courtyard entered through a pylon-like gateway.²⁴⁸ A partially preserved example of one of the pyramids was found over the tomb of Nakht-Min, which shows that they were constructed in A2 bonding, corbelled inwards to create the sloping faces, and covered with plaster.²⁴⁹ Above the vaulted roof of the chapel was the hollow interior of the pyramid, in some cases partly filled with gravel. The doors to both chapel and courtyard were surmounted by cornices,²⁵⁰ which could be made of special bricks designed for the purpose. Often the walls of the court were built of rough stone, but those of the chapels were more commonly of brick, bonded A1 and plastered internally. Examples of the brick sizes are given on page 49: the general dimensions are around 30-35cm for the length, but larger bricks re-used from the royal mortuary temples also occur.

236. McIver, D.R. & Mace, A.C., *El-Amrah and Abydos*, 70.

237. Steindorff, G., *Aniba*, II, 42-7 and Pl.44.

238. Anthes, R., *MDIK* 12 (1943), 18-42 and Pl.1.

239. Hölscher, U., *E.M.H.*, IV, 22-5.

240. *ibid.*, 23-4.

241. Steindorff, G., *Aniba*, II, 43.

242. Bruyère, B., *Deir el-Medineh*, 1922-1926, 1928, *passim*.

243. Bruyère, B. & Kuentz, C., *Les Tombes de Nakht-Min et d'Iri-Nefer*.

244. Bruyère, B., *Deir el-Medineh*, 1934-5, 25.

245. Borchardt, L., *Zeitschrift für Bauwesen* 79 (1929), 111-5.

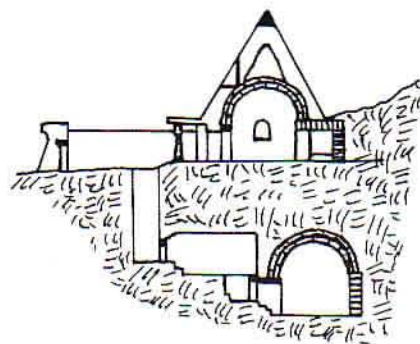
246. Borchardt, L., *op. cit.*, 113-4.

247. *ibid.*, 112.

248. Bruyère, B. & Kuentz, C., *op. cit.*, Pl. XXII

249. *ibid.*, 4 and Pl. II. 250. *ibid.*, Pl. XXII

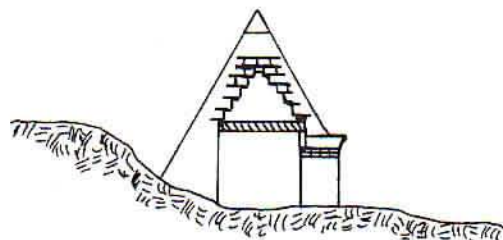
Fig.31 Section of a Tomb at Deir el-Medina.



Dira abu'l Naga.²⁵¹

The brick pyramids which stand over the rock-cut chambers of the tombs of the Nineteenth and Twentieth Dynasty nobles show great uniformity in their construction.²⁵² They are built of grey mud-bricks averaging 33–34cm in length, most frequently laid as headers from each face, although in one case (Tomb 35) the lower courses are of A3 bonding. Reeds are laid in mats between every fourth or fifth course and mud mortar fills the joints on the outer faces. The internal work is roughly done and has hardly any mortar, bricks frequently being turned on edge to compensate for changes in level. A doorway on the East side of the pyramid leads into an interior chapel, which is roofed with a d1 vault of one or two courses thickness. Special bricks, with a thickness of only 4–6cm and grooved sides, are used for this vault. Above the roof the pyramid is hollow, and is gradually closed over towards its apex by corbelling the brickwork on all four sides (Fig.32). The passage which leads to the chapel is covered by an arch of type c1 consisting of two or three rings of brick, whilst the side-walls and door jambs are built in A1 bonding and mortared with mud.

Fig.32 Section of Pyramid, Dira abu'l Naga tomb.



Originally all the interior walls were coated with whitened plaster, as were the outer surfaces of the pyramid. Further brickwork occurs in these tombs in the walls around the courtyard before the entrance to the rock-cut sepulchre. These are built of similar bricks to those used in the pyramids, bonded A2 or A3, and mortared with mud.

The above description applies to the brick pyramidal tombs of Dira abu'l Naga as a whole; minor differences between the individual monuments are stated in the table on page 49.

Parallels to this type of tomb are found in Nubia at Aneiba²⁵³ and Soleb,²⁵⁴ but at those sites a large vaulted chapel stood on the East side of the pyramid. In constructional details, however, the Nubian tombs are almost identical to their Theban counterparts, as is revealed by the information included in the summary chart on page 49.

Apart from the cemeteries discussed above there are two New Kingdom tombs at Thebes which are of special interest by virtue of their construction. The first of these is the tomb of Nebamun, which is of Eighteenth Dynasty date and lies in Dira abu'l Naga.²⁵⁵ This tomb has a facade of brick pierced by five doorways, leading into the transverse outer room, the central doorway being larger than the others. On the outside, these doorways are roofed with stone lintels, but the inner part is covered by brick arches of type c1(1.0), or, in the case of the larger central door, c1(1.5). The remarkable feature about the arches is that they are quite flat, not the usual semicircular arch of Egyptian architecture.²⁵⁶ The transverse hall, into which the doorways open, is roofed with a vault, probably of type d1. All the brickwork, as usual, was originally hidden by a coat of mud-plaster.

The other tomb of structural interest also stands in Dira abu'l Naga, and although not precisely dated must belong to the New Kingdom. It was excavated by Gauthier in 1906 and described by H. Pieron in the published report.²⁵⁷

251. For position see Fisher, C., *PMJ* 15 (March, 1924), 28-49.

252. The details of structure are derived from personal observation.

253. Steindorff, G., *Aniba*, II, Pls. 40-3 and 45.

254. Giorgini, M.S., *Soleb II*, Chapter II.

255. Northampton, *Excavations in the Theban Necropolis*, 14 & Pl. XIV.

256. *ibid.*, Pl. XIV.

257. Pieron, H., *BIFAO* 6 (1908), 173-7 and Pl. XIV.

The interest stems from the use of a dome over one chamber, constructed of bricks measuring 33 x 15 x 6cm, scored with grooves on their upper and lower surfaces. Unlike other domes found in Egypt, for example in tombs of the Old Kingdom at Giza, this dome rests on pendentives at the corners of the room. The dome, built of rings of brickwork of decreasing diameter, is not a true hemisphere, but is composed of an arc around each corner of the chamber, which is not in the correct curve to form a true circle.²⁵⁸ Consequently distortion occurs in the shape of the dome, and further irregularity takes place above the pendentives, since these are not at the same degree of curvature as the dome above them. All these faults would have been hidden by the coating of plaster which was applied to the interior of the roofing.

In the second chamber of the tomb the roof is formed of a *dl* vault, resting at its end upon an arch over a doorway. Pieron considers that it was here that the use of pendentives originated,²⁶⁰ since the first ring of the vaulting left a gap between the side-wall of the room and the arch of the door, which had to be filled somehow. The gap was closed by using part-rings of brickwork extending down from the vault, thereby creating a type of pendentive, the idea of which may then have been retained for use with the dome. Whether this explanation is correct or not is hard to say; in any case it seems to have been a short-lived experiment, as domes on pendentives do not occur again until Coptic times.

It is in the New Kingdom tombs at Thebes that burnt bricks appear in a special usage: stamped with the name and titles of the owner they are set in the angles of the pyramid, and above the frieze, as an extension of the use of funerary cones.²⁶¹ The forms and uses of these bricks are fully described in Chapter 15.

Esna.

Garstang excavated a cemetery at Esna which ranged from the Twelfth to Twenty-Second Dynasty, but only one or two tombs of the Twentieth Dynasty are described in any detail.²⁶² The monument E.250, called by Garstang "The shrine of Hathor" on account of a gilded head of the goddess found within it,²⁶³ is of constructional interest. It consists of a square building with chambers on two levels, linked by a stairway.²⁶⁴ The lower rooms all have vaulted roofs, which are exceptional in making use of the pointed arch, not the semicircular arch normally found in Egyptian architecture. These pointed arches are clearly shown in the photographs which accompany Garstang's report²⁶⁵ to have been of the *cl* type, two courses in thickness. Apparently there were other tombs of the same form at the site, but no details of these are given, except to say that they belong to the Nineteenth or Twentieth Dynasty.²⁶⁶

SUMMARY: NEW KINGDOM TOMBS.

Location	Bonds Used	Brick Sizes(cm)	Notes
<i>Nebesheh:</i>			
21	Irreg.	34 x 16 x (?)	Graves of burnt brick.
35	—	—	—
<i>Yahudieh:</i>	—	35.5–38 x 17–9 x (?) 40.5–43 x 19–20 x (?)	Gable-roofed graves.
<i>Saft:</i>	—	—	Few XVIIIth. Dyn. brick graves. ²⁶⁷
<i>Gurob:</i>			
53	X1	38 x 19 x 9	Brunton's Type: A
256	X1	30.5 x 15 x 10	Type A
289	X1	38 x 19 x 10	Type A
290	—	33 x 16.5 x 9	—
291	—	38 x 19 x 11.5	—
410	—	35.5 x 15 x 10	—
417–8	—	35.5 x 18 x 9	—
434	X1	38 x 18 x 9	Type A
456	—	38 x 19 x 9	—
<i>Sedment:</i>			
1204	—	33 x 16.5 x 11	—
<i>Matmar:</i> ²⁶⁸			
N.K. Cemetery	—	35–8 x 16–9 x 6–10	Graves lined and covered by brick.
258. Pieron, H., <i>BIFAO</i> 6 (1908), 176. 259. <i>ibid.</i>, 177. 260. <i>ibid.</i>, 177. 261. Borchardt, L. <i>et al.</i>, <i>ZAS</i> 70 (1934), 25–35. 262. Garstang, J., <i>ASAE</i> 8 (1907), 141–8. 263. <i>ibid.</i>, 146. This head is now in Liverpool University. 264. Garstang, J., <i>ASAE</i> 8 (1907), 146. 265. <i>ibid.</i>, Pls. XIV–XV. 266. <i>ibid.</i>, 148. 267. Petrie, W.M.F., <i>Hyksos and Israelite Cities</i>, 41. 268. Brunton, G., <i>Matma</i>			

Location	Bonds Used	Brick Sizes(cm)	Notes
<i>Qau:</i>			
N.K. Cemetery	—	30.5–35.5 long.	Bricked pits.
<i>Abydos:</i>			
Underground vaults	x1	—	Vaulted chambers at base of pit.
Chapel-Tombs	—	35.5 x 15 x 10	Brick columns in court. Vaulted inner rooms.
<i>Thebes:</i>			
Dira abu'l Naga			
35	A3	33–5 x 17 x 9–10	<i>Tafl</i> mortar. Reed layers in brickwork.
158	cl dl	34–5 x 17 x 12 30 x 20 x 6	Mud mortar. Reeds every 4th course.
282	cl	33–4 x 16–7 x 9–10	Mud mortar, reed layers. Pyramid is all headers.
283	cl dl	34–5 x 17 x 9–10	Mud mortar & plaster. Reed layers. Vaulted chapel in pyramid.
Deir el-Medina			
1138		30 x 15 x 10	Brick pyramid superstructures.
1156		28 x 16 x 12	
1159		34 x 15 x 10	
1170		30 x 14 x 10.5	
1296		40 x 20 x 12	
1300		40 x 18 x 12	
1308		30.5 x 15.5 x 9.5	
1448		31 x 15 x 8	
1453		38 x 19 x 11 30 x 15 x 9	
Chapels W. of Ramesseum	A2 A3	42 x 19 x 12 30 x 13 x 10	Some bricks re-used from royal temples.
<i>Esna:</i>			
E.250	cl	—	Pointed arches.
<i>Aneiba:</i>			
N.K. Cemetery of brick pyramid and chapel tombs.		37 x 18 x 9 32 x 16 x 7 35 x 17 x 9 36 x 17 x 8 34 x 16 x 7.5	Brick pyramid tombs with vaulted chapels.
<i>Soleb:</i>			
N.K. Cemetery of brick pyramid tombs.		34–7 x 15–7 x 8–10 37 x 20 x 10 38 x 15 x 10 31 x 15.5 x 9 33 x 16 x 9 31 x 17 x 7 38 x 18 x 5 37 x 16 x 6	Common sizes.
			Vault bricks.

11. Brick Tombs of the Twenty-First to Thirtieth Dynasties.

Sais.

On a mound to the North-East of Sais, known as Kawady mound, is the Necropolis of the Late Period belonging to the city.²⁶⁹ The burial chambers of the tombs are roofed with vaults of type d1 and entered by means of narrow passages. Square bricks, measuring 22 x 22cm, are used in the construction of the tombs, both for the floor and for the walls of the chamber,²⁷⁰ and although the former use is not uncommon in Egypt, the occurrence of square bricks in walls is unusual. Possibly this indicates some foreign influence, since square bricks are the general rule in Mesopotamia, and they appear to sites in Southern Palestine after the Twenty-Second Dynasty.²⁷¹

Suwa.

At this site, which lies not far from Saft el-Henneh, there is a cemetery containing tombs of the Twenty-Sixth Dynasty and later.²⁷² Those of the Twenty-Sixth Dynasty are brick-lined and arched, with roofs formed of red bricks about a metre below the ground surface, or else they have the pit divided into four chambers by brick walls.²⁷³

Nebesheh.

The tombs of the Twenty-Sixth Dynasty at Nebesheh are of two types: underground graves, probably vaulted, reached by shallow pits, and large brick multi-chambered tombs which were built on the ground surface.²⁷⁴ No structural details of the tombs are available, except for a brick measurement of 36 x 17.5 x 12.5cm from tomb 42.²⁷⁵

Tell el-Yahudieh.

The form of grave which occurs at this site in the Twentieth Dynasty, consisting of a brick gabled structure over a pottery coffin, continues into this period, but by the Twenty-Sixth Dynasty many graves dispense with the coffin and cover the interment directly with brickwork.²⁷⁶ In the majority of cases the sides of the graves are formed of a single course of stretchers on their edges, and the gabled roof consists of bricks inclined against each other in pairs,²⁷⁷ but one grave has been recorded in which the bricks were laid flat across the roof.²⁷⁸

Qau.

A number of brick measurements are recorded from graves of the Twenty-Sixth to Thirtieth Dynasties at Qau,²⁷⁹ but their consistent similarity to the sizes used in earlier tombs at the same site suggests that they may be re-used. All but two of twelve examples fall between 32 x 15 x 7cm and 34.5 x 16.5 x 10cm, the two exceptions being 30.5cm long. A discussion of the brick measurements of all periods at Qau is included in the section on brick sizes in Chapter III.

Abydos.

The characteristic type of tomb from the Twenty-Second to Thirtieth Dynasties at this site is the large brick-vaulted sepulchre with one or more arched burial chambers. There has been some discussion as to the nature of the superstructures of these tombs: Mariette restored them as pyramids,²⁸⁰ Petrie and Peet argued for truncated pyramids, whilst Mace believed them to have been domed.²⁸¹ As the superstructures are generally destroyed to a low level it is difficult to decide between these alternative suggestions, although the last one seems to be unlikely. The surviving remains show that the pyramids, whether truncated or not, stood over the vaulted chambers and had walls which were corbelled

269. Bakry, H.S.K., *MDIK* 23 (1968), 69-70.

270. *Ibid.*, 69.

271. Petrie, W.M.F., *Gerar*, Pl. LXXII.

272. Petrie, W.M.F., *Hyksos and Israelite Cities*, 47-52.

273. *Ibid.*, 49-50.

274. Petrie, W.M.F., *Nebesheh in Tanis II*, 18.

275. *Ibid.*, 22.

276. Griffith, F.A.I. in Naville, E., *The Mound of the Jew*, 56.

277. *Ibid.*, 50 and Pl. XVI. 278. *Ibid.*, 50 and Pl. XVI.

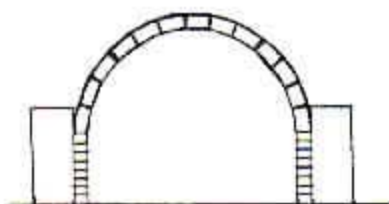
279. Brunton, G., *Qau and Badari*, III, Pl. XXXVIII.

280. Mariette, A., *Abydos, II*, Pls. 66-7.

281. Peet, T.E., *Cemeteries of Abydos*, II, 87-8.

inwards, the interior being left hollow. In the earlier group of tombs, around the Twenty-Second Dynasty, the vault and the substructure were not connected, but later the two parts of the building were more integrated and the walls of the chamber continued upwards to form the sides of the superstructure.²⁸² The burial chambers, which lie at a shallow depth beneath the ground, are roofed with strongly-built vaults of type d1, varying from one to two courses in thickness.²⁸³ In some cases the bricks were hollowed on the underside to give a continuous curve to the vault,²⁸⁴ which was further smoothed by a coat of plaster. Grooves were scored on the faces of the bricks to provide a key for the mortar, for temporary centring was not used during the construction of the roofing. In some tombs, such as E.460, a cd1 vault was employed²⁸⁵ but centring was still not required since the first ring of inclined bricks acted as a support for the bricks laid on edge above. The vaulting usually sprang from a lining-wall of stretchers on the inside of the main substructure walls, as shown in Fig.33. Although the earlier tombs usually had only one burial chamber beneath the superstructure, from the Twenty-Fifth Dynasty it becomes more common to have multiple vaults,²⁸⁶ entered through doorways covered by arches of type c1.

Fig.33 Vault in a Late Period Tomb at Abydos.



Thebes.

The greatest remains of brickwork from funerary monuments of the Late Period at Thebes are to be found in the large tombs of the Twenty-Fifth and Twenty-Sixth Dynasties in Asasif. Of these funerary palaces, three have survived sufficiently to the present day to be of use in a study of brick construction, these being numbers 27, 34 and 279.²⁸⁷

Tomb 27 (Sheshonk)

This structure lies beside the ruins of the temple of Ramesses V, and belongs to the Twenty-Sixth Dynasty. It was enclosed by a brick wall, decorated with simple niches in imitation of the archaic palace-facade, parts of which still remain on the North side.²⁸⁸ The enclosed area is divided by a brick pylon into two courts, and over the doorway is an arch composed of four rings of brickwork.²⁸⁹ This arch is basically of type ex2, except for the fact that the lowest course is built in d1 bonding so as to eliminate the necessity for temporary centring. The gaping joints between the bricks are filled with chips of limestone. A similar pylon formed the entrance to the tomb on the East, but the gateway of this has been blocked with brickwork at a later date and the original structure is not visible. The lowest courses of the walls generally employed headers or bricks on edge, but at higher levels the bonding is slightly irregular A3 with traces of white plaster over the brickwork. Mud mortar was used to fill the horizontal joints and the bricks measure 32-3 x 15 x 10cm.

Tomb 34 (Montuemhat).²⁹⁰

All that remains of the wall which once surrounded this tomb is the great brick pylon which stood on the East side of the courtyard. This is well preserved, and is constructed of grey mud-bricks,²⁹¹ 32-3 x 16 x 10-1cm in size, built together in A3 bonding. On the faces of the brickwork the horizontal joints are filled with mud mortar but the internal structure is practically devoid of any mortaring whatsoever, and the vertical interstices are very wide. Rows of bricks on edge are used to compensate for irregularities in level, and reed-mats occur every four to six courses, laid both transversely and longitudinally through the structure. At the angles of the pylon a type of corner bonding is used which is usually associated with A10 bonding. (See Pl.5.) The most striking feature of the building is the great brick arch over the doorway of the pylon, which has six rings of brick remaining, having lost several courses from the inside. The extant courses are composed of the specially thin bricks normally employed for d1 vaults, but here they are used on edge, as if they were ordinary bricks, to produce an arch of type c1.²⁹² Probably the lost section of the arch would have included courses of

282. Peet, T.E., *Cemeteries of Abydos*, II, 90-1.

283. *ibid.*, 89. 284. *ibid.*, 89. 285. *ibid.*, 90.

286. Garstang, J., *El-Arabah*, Pl. XXXV.

287. *PM*, I, 1: 43, 56, 357. The structural information given here is derived from personal observation.

288. Leclant, J., *Orientalia* 41 (1972), Pl. XXI, Fig. 23.

289. *ibid.*, Pl. XXI, Fig. 22.

290. Leclant, J., *Montouemhat*, 171-186.

291. For the stamps on the bricks, see Leclant, *Montouemhat*, 155.

292. This unusual procedure is paralleled at the Osireion, Abydos.

brick built as inclined vaulting, which could have been built without need for centring and would itself have acted as a centring for the construction of the cl layers above. If this were the case then the arch would have been built in the same way as that of the nearby tomb 279.²⁹³ Attached to the tomb of Montuemhat is a small brick pyramid²⁹⁴ composed of a low square wall of A1 bonding, above which is a square corbel, consisting entirely of headers, rising to an apex. The bricks of this structure are identical to those of the great pylon.

Tomb 279 (Pbes).²⁹⁵

Like the tomb of Montuemhat, this monument possesses a pylon of brick with an arched gateway. The pylon resembles that of tomb 34 in that it is built in A3 bonding and uses a bond of type A10 at the corners, but differs in having no reed layers in the brickwork. Above the gateway is an arch of four rings of brick, the two lower rings being of type d1 and the two upper rings of type c1, giving a bond of cd1 for the whole. The bricks measure 32-3 x 15-6.5 x 10-1 cm and are formed of compact grey mud.

Apart from the monuments of Asasif, there exist at Thebes other brick-built tombs of the Late Period grouped around the temple-area of Ramesses III at Medinet Habu. A number of small graves of Twenty-First Dynasty date were found in the thickness of the fortified West Gate of the temple enclosure:²⁹⁶ these were simple structures roofed with d1 vaults. Within the temenos itself are the tomb-chapels of the God's Wives of Amun of the Twenty-Fifth and Twenty-Sixth Dynasties, and one of these, ascribed to Shepenupet I, was built of brick.²⁹⁷ The walls of this structure were of A2 or A3 bonding and had a stone facing applied over them. An interesting feature of the tomb is the stone vault over the burial chamber which is built in inclined rings of masonry as a direct copy of brick construction.

Other tombs of similar date were found in the temple area, some with brick vaults, but others with stone-lined chambers.²⁹⁸ One example (Number 20b) is of interest in having a floor of burnt brick.²⁹⁹

Outside the girdle-wall of the temple, on its West side, stood a series of mortuary chapels³⁰⁰ of similar style to those of the God's Wives, and to certain tombs at Aneiba in Nubia.³⁰¹ These chapels are presumed to have had vaulted sanctuaries, but they were so destroyed that no trace of the roofs has been preserved and the form of vaulting employed is unknown.

SUMMARY: TWENTY-FIRST TO THIRTIETH DYNASTIES.

Location	Bonds Used	Brick Sizes(cm)	Notes
<i>Sais:</i>			
Late Cem.	d1	22 x 22 x (?)	Vaulted tombs
<i>Suwa:</i>	—	—	Brick-lined and arched graves, of burnt brick.
<i>Nebeshieh:</i>			
Tomb 42	—	36 x 17.5 x 12.5	Underground vaults & surface tombs occur.
<i>Yahudieh:</i>	gabled tombs.	—	Lined with stretchers on edge.
<i>Saqqara:</i>			
Wennefer. ³⁰²	—	—	Superstructure with plastered brickwork.
<i>Matmar:</i> ³⁰³			
XXII-XXV Dyn. Cem.	—	30 x 15 x 7.5 to 36 x 16 x 8	Graves bricked round & over.
<i>Qna:</i>			
594		34 x 15 x 7.5	Bricked substructures
751		33 x 15 x 8	
763		34.5 x 15 x 7.5	
785		32 x 16.5 x 7.5	
801		32 x 15 x 10	
802		32 x 15 x 9	

293. *PM*, I, 1; 357.

294. *PM*, I, 2; 625.

295. See Lansing, A., *BAMIA*, XV (July 1920, II), 16-24.

296. Hölscher, U., *E.M.H.*, V, 4 and Pl. 24 B.

297. *ibid.*, 18-20. 298. *ibid.*, 30-2.

299. *ibid.*, 32.

300. Hölscher, U., *E.M.H.*, IV, 22-5.

301. Steindorf, G., *Aniba*, II, 42-7 and Pl. 44.

302. Quibell, J. F., *Excavations at Saqqara, 1912-14*, 14 & Pl. XXXII.

303. Brunton, G., *Matmar*, 79.

Location	Bonds used	Brick sizes (cm)	Notes
809		32 x 15 x 7.5	Bricked substructures
907		33 x 15 x 7.5	
916		33 x 15 x 7.5	
942		30.5 x 15 x 7.5	
7542		33 x 15 x 9	
7790		34 x 16.5 x 9	
7658		30.5 x 14 x 6.5	
<i>Abydos:</i>			
D57	cdl	Size range: 30-5 x 15-7 x 6-8	Underground vaults entered by arched doors from pit.
G68 ³⁰⁴	cdl		
E404	d1 c1		
E440	d1		
E456	d1 c1		
E460	cdl c1		
<i>Thebes:</i>			
<i>i. Asasif:</i>			
27	A3 cx2	32-3 x 15 x 10	Arch over doorway 4 courses thick. Palace-facade wall.
33	A1 A3	36-7 x 19 x 13	Remains of enclosure wall.
34	A3 cdl?	32-3 x 16-7 x 10-1	Reed mats every 4th - 6th course. No mortar in inner work. Mud mortar in horizontal joints. No reed layers.
279	A3 cdl		
<i>ii. Medinet Habu:</i>			
In W. Gate	d1	—	Vaulted graves.
In tomos.	—	—	Some brick vaults, others stone-built.
Shepenupet I	—	30 x 15 x 8	Brick walls stone faced.
Mortuary Chapels			
W. of Temple.		36 x 17 x 9	Vaulted chambers.

12. Ptolemaic and Roman Tombs.

Qantara.

The Roman cemetery of Qantara contains rectangular brick-built tombs with chambers for multiple burials.³⁰⁵ Burnt bricks, 25 x 12 x 6 cm in size, are used in the construction of these graves, and the chambers are roofed with semicircular arches of type c1 in the same material.³⁰⁶

Tell el-Yahudieh.

The Romano-Jewish tombs which lie in the desert area around the town-site take the form of chambers cut in the gravel with loculi for burials on either side.³⁰⁷ Some of these loculi are built of burnt bricks, which are also employed for the door-posts of the tombs. These bricks measure 23 x 11.5 x (?) cm, whilst the mud-bricks which are used in some cases are slightly larger, being 25.5 x 12.5 x (?) cm in size.³⁰⁸

A short distance further into the desert are more Roman tombs of a different form, continuing the brick-gabled style of grave which occurs at this site from the late New Kingdom. These tombs are built with side-walls of stretchers and paired bricks for the gable-roof, and contain pottery coffins bearing debased inscriptions.³⁰⁹

304. Petrie, W.M.F., *Abydos I*, PL. XXX.

305. Chaban, M., *ASAN* 12 (1912), 69-73.

306. *ibid.*, 69-70, 73.

307. Griffith, F.L. in Naville, E., *Mound of the Jew*, 81.

308. *ibid.*, 52.

309. *ibid.*, 16-7.

Oxyrhynchus.

The tombs at this site are Roman and Coptic, the former being large chambered structures, and the latter being built in the form of chapels.³¹⁰ Most of the buildings are of mud-brick, although in tomb 30 burnt bricks were used to face the ends of the walls and to line part of one chamber.³¹¹ The bonding is mostly of Class A but in some places it becomes type C1. Vaulted chambers were employed in some of the tombs, with plain white or decorated plaster over the brickwork.³¹²

Bacchias, Kasr el-Banat and Harit.

A little information is available about the tombs of the Ptolemaic and Roman Period in the Fayum. At Bacchias the Ptolemaic graves were either small brick gabled structures, or larger buildings with numerous internal rooms.³¹³ The latter type are described by Grenfell³¹⁴ as being "apparently houses used as sepulchres," which may mean that they were similar to the tombs of Tuna el-Gebel. The Roman tombs at Bacchias consisted of mastabas or small brick corbels.³¹⁵

Subterranean vaulted tombs occur at Kasr el-Banat and at Harit,³¹⁶ belonging to the Ptolemaic Period. In Roman times the same type of tomb persists, but the vaulted chambers are larger.³¹⁷

Tuna el-Gebel.

The tombs in this cemetery are built in the form of houses, and although many are entirely constructed of stone others use mud-brick.³¹⁸ Every effort has been made to copy the features of Graeco-Roman town houses in Egypt, in the form of the facade, the stairs to the roof and the windows.³¹⁹ Above the latter are grooves in the brickwork to imitate the wooden beams which are found around the windows of houses at this date in the town sites of the Fayum. The facades of the tombs are covered with white plaster, which is in some cases moulded and channelled to present the appearance of a well-built wall of limestone.³²⁰ There is a torus roll up the edges of the facade, also made of plaster, whilst in the internal rooms coloured plasters are used to reproduce the appearance of various expensive stones, such as marble, porphyry and breccia.³²¹

Thebes.

Brick tombs of the Ptolemaic Period are found in all areas of the West Bank at Thebes, from Asasif to Medinet Habu. They are of threetypes:³²² (i) Large family tombs, (ii) Individual gabled graves, (iii) A poorer version of type (ii). The first group consist of brick chapels built on the ground surface or slightly sunk into the gravel, entered by an arched door.³²³ The whole tomb is surrounded by rectangular side-walls from six to ten courses in height, the roofing vault being sprung from ledges in these walls. Vaults of x1 or d1 form occur, all using thin grooved bricks, some examples from the area of Hatshepsut's Valley Temple being 34 x 16 x 6cm in size,³²⁴ whilst the bricks of the side-walls ranged from 28 x 15 x 10cm to 31 x 15 x 10cm.³²⁵

The graves of type (ii), designed for a single extended burial, are formed of a brick-lined pit covered by a gable roof of two bricks abutting against each other. (Fig.34) At the ends of the grave the brick wall rises higher than the gable roof, whilst the side-walls of the pit are only five courses high and are bonded X1.³²⁶ A poorer style of this same grave-type makes up the third class, in which the pit is walled round with a single course of brick on edge, upon which the gabled roof rests.³²⁷ The end-walls of these graves do not rise above the level of the roof as in type (ii), but consist only of two courses of bricks laid on edge as stretchers.³²⁸

310. Petrie, W.M.F., *Tombs of the Courtiers & Oxyrhynchus*, 16-7.

311. *ibid.*, 18.

312. Petrie, W.M.F., *op. cit.*, 17-8 and PLXLV.

313. Grenfell, B.P. et al., *Fayum Towns and their Papyri*, 41.

314. *ibid.*, 41.

315. *ibid.*, 41-2.

316. *ibid.*, 55.

317. *ibid.*, 56.

318. Gabra, S., *Hermopolis Ovest*, 2.

319. *ibid.*, 2 and Pls. II, III, VIII. 320. *ibid.*, 39 and Pl. VIII.

321. Gabra, S., *Peintures à Fresques et Scènes Peintes*, Pl.21.

322. Robichon, C. & Varille, A., *Amenhotep fils de Hapou*, 43-4.

323. *ibid.*, 44 and Fig.11. Carter, H., *Five Years' Explorations at Thebes*, 43-4 & Pls. XXXIII-XXXIV. Winlock, H.E., *BAMIA IX* (1935), supplement, 5.

324. Lanling, A., *BAMIA XXX* (1935), supplement, 5.

325. Carter, H., *op. cit.*, 44.

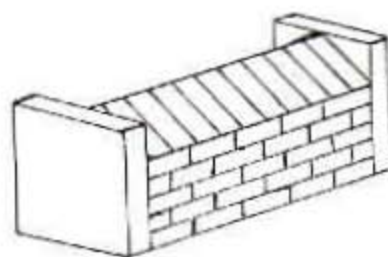
326. Robichon & Varille, *op. cit.*, Pl. V.

327. *ibid.*, 44-5 & Pl. XLVI.

328. Robichon, C. and Varille, A., *op. cit.*, 45 and Fig. 11, III.

329. *ibid.*, 44-5 and Pl. XLVII.

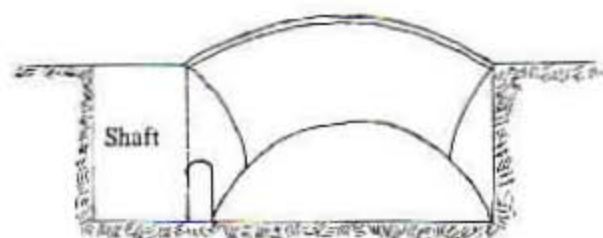
Fig.34 Ptolemaic Tomb for single burial, Thebes.



A cemetery of Roman date lies in the area of the mortuary temple of Ay, near Medinet Habu.³²⁹ The tombs are sunk into the ground to a depth of 1.5 to 2.2 metres, and are reached by means of an arched door at the base of a shallow pit³³⁰ (Fig.35) Above the burial chamber is a dome roof which projects above the surface of the ground and forms the superstructure of the tomb. This dome is composed of rings of brickwork of gradually decreasing diameter, the bricks being tilted inwards towards the centre until they eventually meet.³³¹ Other tombs in this cemetery had rectangular chambers built of bricks measuring 30 x 14 x 8cm and roofed with vaults of type bx1.³³²

At Deir el-Medina some graves of a later date were found, belonging to the Coptic period. These take the form of small brick superstructures over shallow pits, roofed over with *di* vaults.³³³

Fig.35 Roman Tomb at Thebes



Armant.

Some of the best recorded brickwork in Egypt occurs in the tombs of the sacred Buchis bulls at Armant, ranging in date from the Thirtieth Dynasty to the late Roman Period. The brickwork of all ages is described here since it would have been inadvisable to treat the constructions of the Thirtieth Dynasty separately from the later buildings.

In the Bucheum, as well as in the tombs of the cows, known as the Baqaria, the brickwork is employed for paving, lining walls, door blockings and roofing the burial vaults and the passages.³³⁴ A number of complex bonding systems are coming into use, anticipating the decorative bonds of Coptic times.³³⁵ The detailed information³³⁶ concerning the arrangements and dimensions of the bricks at the various periods is given in the following chart, together with the provenance of each measurement. The letter B stands for Bucheum, and Bq for Baqaria, whilst the use of burnt brick is indicated by an asterisk after the brick size.

Date	Location	Bonds	Brick Sizes(cm)	Date	Location	Bonds	Brick Sizes(cm)
Nekhtorheb	B.10 vault Bq.30	A3	38 x 18 x 12	Ptolemy I	vault ramp Bq.11	cx1	35 x 17 x 32 x 6 (shaped) 29 x 14.5 x 8*
		cx1	37 x 17 x 6			—	31 x 14.5 x 12
		C1	32 x 17 x 12			—	33 x 15 x 11
			29 x 14 x 7			C1	31 x 13.5 x 10
Alexander I	B.Ramp(G)	—	33 x 16 x 10	Ptolemy V	Bq.8	—	33 x 16 x 10
			36 x 16.5 x 10	Ptolemy VI	Bq.9	X1	33 x 16 x 10
			35 x 14 x (?)	Ptolemy IX	Bq.6	C1	29.5 x 14 x 6
			35 x 16 x (?)	Ptolemy XI	Bq.7	—	30 x 15 x 9*
			38 x 17 x (?)		Bq.7	A1	34 x 15 x 10
			33 x 15 x 10		Bq.7	A1	34 x 16.5 x 11
		A1	33 x 16.5 x 11				
		A2	33 x 16.5 x 11				

329. Höfischer, U., *E.M.H.*, V, 42, Pl.28 F.

330. *ibid.*, 42.

331. *ibid.*, 42.

332. *ibid.*, Pl.28 K.

333. Bruyère, H., *Deir el-Medineh*, 1935-40, Fasc. I, 45.

334. Mond, R. & Myers, O.H., *The Bucheum*, I, 28-52; III, Pls.XII-XXXII.

335. *ibid.*, III, Pl. CXII.

336. *ibid.*, I, 50-2.

Date	Location	Bonds	Brick sizes (cm)	Date	Location	Bonds	Brick sizes (cm)
Augustus	Bq.14	—	29 x 14 x 8			A3	29 x 14 x 7*
	Bq.17	—	32 x 14.5 x 10			A3	34 x 17.5 x 9
Tiberius	Bq.4	C1	30 x 14 x 10			A3	33.5 x 17 x 9
	Bq.16	—	33 x 16.5 x 10			C1	30 x 15 x 9*
Gaius	Bq.18	—	29 x 14 x 7.5			C1	30 x 15 x 7.5*
Nero	Bq.23	—	29 x 14 x 7.5			D1	33 x 16.5 x 11
Vespasian	Bq.19	A2	32 x 15 x 7*			D1	33 x 16 x 10
	vault	a1	32 x 15 x 7*			D1	33 x 16.5 x 11
	Blocking Wall	—	31 x 15 x 7*	(Roman)	S. passage:		
		—	29.5 x 14.5 x 9		vault.	d2	26 x 26 x 7*
Domitian	Bq.20	B2	28 x 12 x 6*		walls.	A1	29 x 14.5 x 8*
	Bq.20	C1	29 x 14 x 7.5*			A2	29 x 14.5 x 8*
	Bq.20	C7	29 x 14 x 7.5*			A3	29 x 14.5 x 8*
	vault	c1	28 x 12 x 6*			A2	32 x 14 x 7*
Trajan	Bq.24	A1	32 x 15 x 7*			A1	32 x 14 x 7*
Hadrian	Bq.25	—	30 x 14 x 10			A1	32-3 x 15-6 x 6-7*
	Bq.25	B1	32 x 15 x 7*		B. :		
	vault	a1	32 x 15 x 7*	Late	W. passage:		
Antoninus				Ptolemaic	vault.	a1	36 x 18 x 5.5
Pius	Bq.21	B1	29 x 15 x 7.5*	Roman	walls.	A1	33.5 x 16 x 6*
	Bq.26	A1	29 x 14.5 x 7*			A2	31.5 x 15 x 10
	vault	f2	29 x 14.5 x 7*			A2	33 x 16 x 10
	Bq.27	A1	28 x 14 x 8*			A2	29.5 x 14.5 x 8
Marcus						A2	32 x 16 x 7*
Aurelius	Bq.22	—	31 x 15 x 8*			A3	35 x 16 x 11.5
		—	28 x 14 x 8*			A3	29.5 x 14.5 x 8
Commodus	Bq.28	—	32 x 15 x 8*			C6	33 x 16 x 10
Valerian	B.9	A1	32 x 16 x 7*			C7	31 x 15.5 x 7.5
		A2	32 x 16 x 7*			C1	31 x 15 x 10.5
		C7	30 x 15 x 7*			AC1	31 x 15 x 10*
	Bq. :					A3	31 x 15 x 10*
(Roman)	N. passage				B. :		
	vault.	c1	31 x 15 x 7*		N-S passage		
		—	26 x 26 x 7*	Roman	walls.	A2	34.5 x 17 x 10
(Roman)	N. passage					A2	36.5 x 18 x 8*
	walls.	A3	32 x 16.5 x 11			C1	33 x 16 x 7*
		A3	31 x 15.5 x 7*			C7	30 x 15 x 8.5
		A3	33 x 15 x 10			D2	30 x 15 x 7*

From the above information it can be seen that the early bricks are large, whilst those of the later Ptolemaic and Roman constructions are generally 30 to 35cm in length. Burnt bricks are used fairly consistently from the time of Vespasian, whereas in earlier periods they tend to be employed only in places in which extreme wear was expected, such as the ramp of tomb 31 in the Baqaria. An attempt by the excavators³³⁷ to discover the unit of manufacture of these bricks led to great difficulties, since the sizes are so closely graduated that there is no distinction between one group and the next. Only in certain special cases is it possible to be sure about the metrology of individual bricks.

The bonding is frequently of the common Class A form, although type C is becoming more popular. Systems which employ Class B bonding, or the more complex arrangements D1, AC1 and AD1, are all of later times, from Domitian onwards.³³⁸ In the early tombs dated to Neklihorheb and Alexander the vaults are bonded ex1 and vary from six to eight courses in thickness.³³⁹ The Roman vaults, which are of burnt brick, are only two courses thick and make general use of a1, c1 or d2 bonding, although a single case of type f2 occurs.³⁴⁰ For the roofing of the long passages in the Baqaria the old system of inclined courses of brickwork was employed, but with the new feature of specially-shaped burnt bricks measuring 26 x 26 x 7cm.³⁴¹

337. Mond, R. and Myers, O.H., *The Bucheum*, I, 48-9.

338. *Ibid.*, 50-2, and III, Pls.CXII-CXIV.

339. *Ibid.*, I, 50, 52. 340. *Ibid.*, 50-2 and III, Pl.CXIII.

341. Mond, R. & Myers, O.H., *The Bucheum*, I, 51.

There are some discrepancies in the recording of the forms of arches and vaults found at this site, which cause difficulties in using the published information. Certain types of vault included in Myer's Corpus³⁴² are not recorded as having been used anywhere on the site, and the form of the well-preserved vault of tomb 30 in the Baqaria³⁴³ is not stated. In addition, the code letter *a* is used in the Corpus to describe two entirely different constructional arrangements, A1a and A2a.³⁴⁴ It was the presence of this ambiguity which led to the formation of the new Corpus included in this study, to which all the bonds in the above list refer.

Kharga.

In the oasis of Kharga are early Coptic tomb-chapels of the third and fourth centuries, built of brick with domes and *d1* vaults for roofing.³⁴⁵ Some of the chapels have triangular windows formed of two gabled bricks, as occur in the 'castle' at Karanog in Nubia.³⁴⁶

SUMMARY: BRICKWORK IN PTOLEMAIC AND ROMAN AGE TOMBS.

Location	Bonds Used	Brick Sizes(cm)	Notes
<i>Qantara:</i>	<i>c1</i>	25 x 12 x 6	Roman burnt brick vaults.
<i>Yahudieh:</i>			
Chamber-tombs		23 x 11.5 x (?) 25.5 x 12.5 x (?)	Burnt brick.
Gabled-tombs	XI	—	Mud-brick tombs.
<i>Kom Abu Bilhu:</i> ³⁴⁷			
Roman Cem. ³⁴⁹	—	—	Small brick superstructures in truncated pyramid form.
<i>Saqqara:</i>			
Teti Pyr. cem. ³⁴⁸	—	—	Brick superstructures over Roman graves.
<i>Hawara:</i>			
Roman Cem. ³⁵²	—	—	Chambered tombs. Small brick pyramids.
<i>Bacchias:</i>		—	Ptolemaic chambered tombs & gabled graves.
<i>Kasr el-Banat and Harit:</i>		—	Underground vaults.
<i>Oxyrhynchus:</i>	A1 C1	—	Roman chamber-tombs, Coptic chapels.
<i>Tuna el-Gebel:</i>	—	—	House-tombs. Vaulted rooms. White & coloured plaster.
<i>Qau:</i> ³⁵⁰			
1907	—	33 x 15 x 7.5	Bricked pit.
<i>Abydos:</i> ³⁵¹			
Ptol. tombs	<i>d1 x1</i>	—	Underground vaults, mastaba on surface.
<i>Thebes:</i>			
Ptol. tombs	<i>d1 x1</i>	28 x 15 x 10 30 x 15 x 10 34 x 16 x 6(Vault)	Vaulted chapels on ground surface. Arch over entrance door. Small gabled graves with walls of stretchers.
	XI	28-30 long.	
<i>Medinet Habu:</i>			
Roman Cem.	<i>bx1</i>	30 x 14 x 8	Domed and vaulted tombs sunk into ground.

342. *Ibid.*, III, Pls. CXII-CXIV.

343. *Ibid.*, III, Pl. XXXI.

344. *Ibid.*, III, Pls. CXIII-CXIV.

345. Winlock, J.L., *BMAA* XXVII (March 1932, II), 38-50.

346. Woolley, L., *Karanog, The Town*, Pl.3.

The precise date of this building is not known.

347. Leclant, J., *Orientalia* 40 (1971), 228 & PLXXXIV fig.11.

348. Quibell, J.E. & Hayter, A.G.K., *Tert Pyramid, North Side*, 2-3, Pl.3.

349. Petrie, W.M.F., *Roman Portraits & Memphis IV*, 3, 19, Pls. XVII, XXII, XXIII.

350. Brunton, G., *Qau & Badari*, III, 26, Pl. XXXIX.

351. Peet, J.E., *Cemeteries of Abydos*, II, 88.

Location	Bonds used	Brick sizes (cm)	Notes
Deir el-Medina: Coptic Cem.	d1	—	Small vaulted graves.
<i>Armant:</i> Roman Cem. ³⁵²	—	27 x 16 x 7	Bricked over.
501	—	25 x 25 x 5	Bricked over.
504	—		
(For the Bucheum, see above pp.55-6)			
<i>Kharga:</i> Copt. tombs.	d1	—	Large chapel-tombs roofed with vaults & domes. Gabled windows.

352. Myers, O.H. and Fairman, H.W., *JEA* 17 (1931), 228 & Pls. LVIII, fig. 1.

CHAPTER FIVE: RELIGIOUS ARCHITECTURE

1. Temples of the Earliest Dynasties.

The earliest structure which can be classed as a temple in Ancient Egypt is the complex of chambers built on to the North end of Tomb 3505 at Saqqara,¹ forming a prototype mortuary temple which can be compared with that of the Step Pyramid of Djoser. This temple has walls built entirely of brick, decorated in one room by affixing reed mats to their faces.² The brick bonding of the walls is not recorded; Emery's plans show the layout of the brickwork to be A3, but the drawings are conventionally done, and cannot be taken as an indication of bonding systems.³

There are few other remains in Egypt to illustrate the religious architecture of the early dynasties. The temple of Hierakonpolis, although established in the Second Dynasty, was entirely reconstructed in the New Kingdom, and all the brickwork of the walls and pylons dates from the Eighteenth Dynasty.⁴ At Medamud a protodynastic temple has been discovered,⁵ consisting of an enclosed area containing two mounds, over which there was probably a grove of trees. The excavations revealed that there had been passages to the heart of the mounds lined with brick,⁶ but it seems that this brickwork was so destroyed that no details could be obtained, as none are given in the report.

Traces of an early temple have also been found at Abydos,⁷ but the precise date of the brick walls is uncertain, making them of little use for a study of this kind.

2. Pyramid Temples of the Old Kingdom.

The Temples of the Bent Pyramid of Dashur.

Several levels of building were found in the funerary temple of the Bent Pyramid at Dashur, the first three levels belonging to the Old Kingdom and another three being later additions.⁸ The same rough, irregular bonding is used in all these stages of construction, and all the brickwork is covered with plaster. In the Old Kingdom levels the bricks are 35 x 17.5 x 10cm in size, whilst the later structures, dating from the Middle Kingdom, use bricks measuring 35 x 25 x 15cm and 30 x 15 x 10cm.⁹

Abu Roash.

In the Upper Temple of the pyramid of Radjedef a number of brick-built rooms were excavated and insufficiently published by Chassinat.¹⁰ The chambers were built of bricks measuring 33 x 17 x 11cm with a 3 cm plaster coat on the walls, and probably had wooden roofing.¹¹ No other details are available.

Giza.

Brick is employed as a building material only in the temples of the pyramid of Mycerinus and in the pyramid-temples of his queens. Much of this brickwork is not part of the original plan but is a later addition carried out under Shepseskaf to complete the mortuary complex of his predecessor.¹² In the Upper Temple, it had been intended to face the walls with granite ashlar, but only a few stones were ever placed in position and the casing was completed in brick.¹³ These casing walls had plain surfaces coated with mud-plaster, except in the Great Court, where they were decorated with niches in a simplified form of the palace facade.¹⁴ The bonding used in the thinner walls is generally A2 or A3, but certain of the main walls employ the more complex bond A10. This has a distinctive arrangement at the corners, where two superimposed stretchers alternate with two headers one above the other. (See Pl.5) The internal brickwork of walls of this type includes

1. Emery, W.B., *Great Tombs of the First Dynasty*, III, 10, 13.
2. *Ibid.*, 10, Pl.25.
3. *Ibid.*, Pls 2-3.
4. Quibell, J.E., & Green, F.W., *Hierakonpolis*, II, 14.
5. Robichon, C. & Varille, A., *Temple primitif de Medamoud*.
6. *Ibid.*, 1, and plan.
7. Petrie, W.M.F., *Abydos*, II, 7-9 and Pls. L-LI.

8. Fakhry, A., *Monuments of Sneferu at Dashur*, I, 98-104 & Fig.57.
9. *Ibid.*, 101-3 & Fig.57.
10. Chassinat, E., *CRAI* 1901, 616.
11. Maragioglio, V. & Rinaldi, C., *Piramidi Menfite*, 5, 18-22.
12. Reisner, G.A., *Mycerinus*, 30.
13. *Ibid.*, 30, 80-1.
14. *Ibid.*, 25.

rows of stretchers which shift position from one course to the next, thereby forming a firm longitudinal bond in the heart of the wall.¹⁵ (See Pl.5) In the Mycerinus complex the bond A10 is used extensively in the plain walls, and in the niched wall of the Great Court of the Valley Temple. The distinctive corner bonding which is usually associated with brickwork of type A10 is used here in most of the A2 and A3 walls also. One of Reisner's diagrams¹⁶ shows logs of wood inserted into the brickwork at intervals, but he makes no mention of this feature in the text. The recessed panelling of the lining walls of the open courts in both the Upper and Lower Temples is bonded into the wall.¹⁷

No real attempt was made to prepare good foundations for the brick walls in any part of the complex, the bases of the walls going down only to a depth of one to seven courses below the floors.¹⁸ This was achieved by raising the level of the floor after the walls had been completed by means of gravel covered over with mud-plaster.¹⁹ Plaster was also employed over all the brickwork, being a distinct yellow colour in the buildings of Shepseskaf and black in the later structures of the Fifth and Sixth Dynasties.²⁰

On top of the corridor walls in the Valley Temple the ends of wooden beams were found, 20cm in diameter and placed 15-19cm apart.²¹ These were intended to support planks laid over them, and above the plank roof were several courses of brick, in rather similar fashion to the roofing employed in Saqqara tomb 3035. The planks were 6cm thick and the roof was upheld by wooden columns in the larger rooms, standing on bases of limestone or alabaster.

All the doors in the temple complex were built of wood, set between brick jambs, which were cased with wood or stone.²² The casing of the jambs was nowhere preserved, so the method by which it was attached to the brickwork is not known. Stone casings over brick walls usually stand by their own weight, but when wood is employed it has to be fixed to the brickwork by beams set into the wall, as occurs in the mortuary temple of Neferirkare at Abusir.²³

The bricks used in the temples of Mycerinus varied from 34 x 16 x 9cm to 41 x 20 x 12cm. A size of 40 x 20 x 12cm was most common,²⁴ and it occurred also in the later reconstruction of the Valley Temple in the Sixth Dynasty, but this may indicate a simple re-use of the original bricks.

South Saqqara.

No brickwork is preserved in the area of the mortuary temple of the Mastabat el-Fara'un, except for the niched enclosure wall which surrounded the court,²⁵ the bricks of which measure 31 x 15 x 8cm. The Causeway from the temple is interesting in being entirely brick-built, and roofed with a vault of type d1, parts of which have survived.²⁶ The plaster which was used over all the brickwork of this monument is of a yellow colour,²⁷ as is the plaster on the buildings of Shepseskaf at Giza.

Abusir.

The mortuary temple of Neferirkare, like that of Mycerinus, was completed hastily in brick after the death of the king. In pyramid-temples of the Old Kingdom brick seems to have been regarded as a second-class building material, and was only employed in cases where speedy construction was more important than the enduring qualities of the building.

The main walls of Neferirkare's temple are bonded A3, whilst A1 is used for the thinner walls. There is occasional use of bricks on edge for adjusting levels, or for foundation courses. In the Entrance Hall there is some A6 bonding in the lower courses of the walls, which changes to A3 above.²⁸

Wood was used in the temple for columns, and presumably for roofing, as well as for the casing of the door-jambs. A doorway on the North side²⁹ had a wooden casing over the jamb attached by means of two beams set into the brickwork, as shown in Fig.36. The threshold of the door was of stone.³⁰

There is some variation in the sizes of the bricks used in the temple, being 25-7 x 11.5-14 x 8.5cm in the facade wall and 27-9 x 13.5 x 8cm in the Entrance Hall.³¹

The funerary temples of the other pyramids at Abusir used brick to a very limited extent, the only substantial construction in this material being the older enclosure wall of the temple of Neuserre, which employed bricks measuring 31 x 15 x 9cm in A3 bonding.³²

15. Reisner, G.A., *op. cit.*, 90.

16. *Ibid.*, 89.

17. *Ibid.*, 90.

18. *Ibid.*, 91.

19. *Ibid.*, 91.

20. *Ibid.*, 90.

21. *Ibid.*, 91-2.

22. *Ibid.*, 94-5.

23. Borchardt, L., *Das Grabdenkmal des Königs Neferirkare*, 38.

24. Reisner, G.A., *op. cit.*, 73.

25. Jéquier, G., *Le Mastabat Farafra*, 16-7 and Pl. IX.

26. *Ibid.*, 20 & Pl. X.

27. *Ibid.*, 16, 20.

28. Borchardt, L., *op. cit.*, 17.

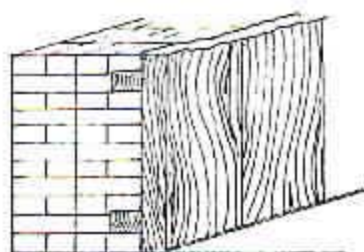
29. Borchardt, L., *op. cit.*, 38.

30. *Ibid.*, 38.

31. *Ibid.*, 15, 17.

32. Borchardt, L., *Das Grabdenkmal des Königs Neuserre*, 147, Pl. 1.

Fig.36 Wood-cased jamb,
Neferirkare Temple.



3. Mortuary Temples of the Middle Kingdom.

The earliest monument in this group which contains any brick construction is the unfinished temple of Sankhkare Mentuhotep at Thebes. No details of the brickwork are available, but it is worth noting the presence of sinusoidal walls on the temple platform.³³

The information concerning the funerary temples of the Middle Kingdom pyramids is rather limited, due partly to lack of excavation but more so to inadequate reporting. Considerable remains of brickwork were discovered by the American excavators at Lisht, but only a brief account of the work was given in the *Bulletin of the Metropolitan Museum of Art*,³⁴ and no final report has yet appeared.

At Illahun, no brick remains are recorded on the site of the mortuary temple of Sesostris II, but nearby was a building described by Petrie³⁵ as a Heb-Sed Chapel, which had a brick floor composed of headers laid in even rows.³⁶ The Valley Temple of the pyramid lay close to the town of the workmen, and was enclosed on three sides by a brick wall 12m thick, lined with slabs of limestone.³⁷ This wall had been denuded to ground level and consequently the arrangement of the brickwork could not be examined. Remains of other walls were found in the temple area, one of which had a sloping socle formed of headers laid on a slant. Petrie suggested that this feature was intended to shoot out any water dripping from the top of the wall to a distance where it would not soak into the foundations, and thereby weaken the structure.³⁸

No information is available from the funerary temples of the Middle Kingdom pyramids of Dashur, the only surviving brick buildings being some priests' houses just North of the causeway of the pyramid of Amenemhat III.³⁹ These structures are described in Chapter 7.

At Abydos, some interesting brick construction is found in the temple of Sesostris III, which was attached to his cenotaph there.⁴⁰ Frequent use is made of walls built on a wavy plan, both in the main temple and beside the dummy mastabas which lie close by,⁴¹ the bricks of these walls measuring 30.5 x 12.5 x 10cm as do the bricks of the whole building.⁴² The bonding used in the various constructions is not recorded in detail, but the published photographs show that some sections were probably type A2 or A3.⁴³

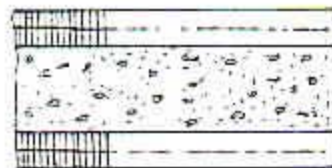
Sesostris III also built a Valley Temple at this site,⁴⁴ surrounded by a buttressed enclosure wall, the angles of which are protected with stonework. All the brickwork of the building had originally been coated with whitened mud-plaster on the exterior surfaces.⁴⁵

No brick constructions have been found among the great works which Amenemhat III undertook beside his pyramid at Hawara,⁴⁶ but at Mazghuneh traces of a brick-built chapel were discovered on the East of the Southernmost pyramid.⁴⁸ In the walls of this chamber most of the bricks were laid as stretchers, with the occasional layer turned on their edges for levelling whilst larger bricks were used for the vault. The following sizes of bricks are recorded:⁴⁹ 30 x 15 x 10cm, 32 x 15 x 11cm, 34.5 x 15 x 11.5cm, 38 x 20.5 x 9cm.

At the North Pyramid of Mazghuneh there were traces of a causeway on the East side,⁵⁰ the walls of which were constructed of a pair of parallel thin walls with rubble filling between, as shown in Fig.37 below.

Fig. 37 Side-wall of Causeway, North Pyramid,
Mazghuneh.

Plan



33. Winlock, H.E., *BMMA* XVI (Nov. 1921), 31 fig.2.

34. Lythgoe, A.M., *BMMA* X (Feb. 1915, supplement), figs. 7-12.

35. Petrie, W.M.F., *Lahun*, II, 20.

36. *Ibid.*, Pl. XX.

37. Petrie, W.M.F., *Kahun, Gurob & Hawara*, 21.

38. Petrie, W.M.F., *Lahun*, II, 40.

39. De Morgan, J., *Fouilles à Dachour*, 1894-5, 100.

40. Weigall, A.E.P. & Currelly, C.T., *Abydos*, III, 11-21.

41. *Ibid.*, 17-8. Pls. XXXVI & XLII.

42. *Ibid.*, 12.

43. *Ibid.*, Pl. XLII.

44. McIVER, D.R. & MACE, A.C., *El-Amrah and Abydos*, 57-60, Pls. XX-XXI.

45. *Ibid.*, 59.

46. Petrie, W.M.F., *Hawara, Rishmu & Arsinoe*, 5 & Pl. XXV.

47. Petrie, W.M.F., & Mackay, E., *The Labyrinth, Gerzeh & Mazghuneh*, 48-9 & Pls. XXXIX, XLI, XLV.

48. *Ibid.*, 48.

49. *Ibid.*, 48.

50. *Ibid.*, 55.

4. Cultus Temples of the Old and Middle Kingdoms.

Old Kingdom Solar Temples.

The earliest building phases in the Solar Temple of Neuserre at Abusir used brick as the major constructional material and some of this brickwork survives despite the later reconstruction of the temple in stone. A great retaining wall surrounds the temple site, holding in the filling upon which the monument stands. This wall is of trapezoidal section, an ideal form for the purpose which it serves and is built of bricks 40cm in length, laid as headers.⁵² Within the temple itself the brick walls are commonly bonded A2 or A3, and in some cases have a double coat of plaster.⁵³

Near the site are the remains of a constructional ramp with four courses of brick still in place.⁵⁴ Also in the vicinity of the temple is a great solar boat, the brick courses of which are laid in a concave pattern to imitate the planking of a boat of wood.⁵⁵ This leads to difficulties in bonding, and the bricks are laid all ways up to fill the irregularities.⁵⁶

In the Solar Temple of Userkaf the walls are bonded A3 in part, but frequent examples of more careless building occur in which only the faces of the walls are neatly bonded, whilst the internal work is a mass of haphazardly laid bricks.⁵⁷ In the centre of the temple courtyard is an altar of brick in slightly irregular A1 bonding, covered over with whitened plaster.⁵⁸ On the East side of the building is the Causeway, extending to the Lower Temple, flanked by walls of brick in rough A1 bonding with each course stepped back a little to produce a batter on the face.⁵⁹ Bricks measuring 28 x 13 x 7cm were used in the earliest stages of building the temple, whilst later additions were made in bricks 27 x 13 x 8cm and 29 x 13 x 8cm in size.

Other Old Kingdom Cultus Temples.

Remains of a temple of Pepi I have been discovered at Bubastis, built largely of stone but enclosed by an outer wall of brick. Few details are recorded about the structure of this building, but the bricks of this wall are stated to have been 18 x 9cm in size.⁶¹

Pepi I also built at Abydos, where he added an enclosure wall around the temple of Osiris-Khentamentiu.⁶² The dimensions of the bricks used in this construction, and those of other Old Kingdom buildings in the same temple area, are given on page 63.

Middle Kingdom Cultus Temples.

At Hermopolis, the German excavators found a gateway set in a brick pylon, belonging to a temple of the Middle Kingdom.⁶³ The bricks of this pylon measure 48 x 24 x (?)cm, are irregularly bonded, and white-plastered to a thickness of 2cm on their exposed faces. Part of the wall of the temple was found on the West side, bonded A3 with many irregularities, whilst in the forecourt some A9 bonding was used.⁶⁴ On the East of the area there was a wall of the sinusoidal type, bonded X1, and extending for a distance of 40m.⁶⁵ The purpose of this structure was to act as a retaining wall to support a higher level of filling in the middle of the temple-area, where there was a ramp and pathway for the gate. Flanking the pathway were pits which had once held trees, each pit being lined with a single course of mud brick.⁶⁶

A number of buildings of Middle Kingdom date exist at Abydos, from both the Eleventh and Twelfth Dynasties, but in most cases the brick sizes are the only structural information given, and these are included in the table on page 63. However, the great enclosing wall of the Osiris temple, possibly built by Sesostri I, is described to a greater extent.⁶⁸ This is constructed in separate panels of brickwork and presents the appearance of alternate concave and convex sections, a feature of many temple-enclosure walls. Some parts have been repaired in later periods, mainly in New Kingdom and Roman times.

51. Borchardt, L., *Das Reichthum des Königs Ne-Woser-Re*, I, 68.

52. *Ibid.*, 69-70.

53. *Ibid.*, 67-9.

54. *Ibid.*, 60.

55. *Ibid.*, 52, Abb. 46.

56. *Ibid.*, 54, Abb. 48.

57. Riecke, H., *Das Sonnenheiligtum des Königs Userkaf*, I, plan 6.

58. *Ibid.*, 24-31 & Pl. 18.

59. *Ibid.*, 31-3 and Pl. 24.

60. *Ibid.*, 33.

61. Habachi, L., *Tell Basta*, 13.

62. Petrie, W.M.F., *Abydos*, II, 10-2 and Pl. LIII.

63. Roeder, G., *MDIK* 7 (1937), 12-7.

64. *Ibid.*, Plan II.

65. *Ibid.*, 13 and Pls. 1-11.

66. *Ibid.*, 12 & Plan II.

67. Petrie, W.M.F., *Abydos*, II, 6-7 and Pl. XLVIII.

68. Petrie, W.M.F., *Abydos*, II, 6-7 and Pl. XLVIII.

At Medamud a wall 9m in thickness was found which may have formed the Middle Kingdom temple enclosure, although its attribution to the Twelfth Dynasty is not certain.⁶⁹ Unlike the later girdle-walls of the temple, the brickwork is laid in level courses instead of alternate concave and convex sections.⁷⁰

A short distance further southward at Thebes a small temple or chapel built by Sankhkare Mentuhotep stands high up on a peak North of the Valley of the Kings.⁷¹ It has brick pylons and walls, the latter being crowned with stone crenellations. The faces of the walls show alternate courses of headers and stretchers, so the bonding is most probably A1 or A2, whilst the bricks themselves measure 30 x 15 x 9cm.⁷²

A few vestiges of Middle Kingdom brickwork have been discovered at Tod, comprising some foundations of the temple of Sesostri I, using bricks 37 x 17 x 12cm in size.⁷³

Below follows a summary of the limited information on the brick architecture in cultus temples of the Old and Middle Kingdoms. The lack of details is, of course, mainly due to the fact that so few temples of this age have survived.

SUMMARY: CULTUS-TEMPLES, OLD AND MIDDLE KINGDOMS.

Location	Bonds	Brick Sizes(cm)	Notes
<i>Abu Gurab:</i>			
Neuserre T.	A2 A3 A6	40cm. long	Buttress-wall of headers. Brick boat.
Userkaf T.	A3 Irreg.	28 x 13 x 7.5 27-9 x 13 x 8-9	White-plastered brickwork.
<i>Bubastis:</i>			
Pepi I T.	—	36 x 18 x 9	Brick enclosure wall.
<i>Abydos:</i>			
Pepi I wall	—	from 29 x 14.5 x 8 to 39.5 x 19.5 x 14.5	
Vth Dyn. buildings	—	from 29 x 11 x (?) to 32 x 16 x (?)	
XIth Dyn.	—	from 27 x (?) x (?) to 31 x 15.5 x 8.5	
XIIth. Dyn.	—	from 35 x 18 x 10.5 to 36.5 x 19.5 x 11	
<i>Hermopolis:</i>			
M.K. Temple:			
pylon. . . .	Irreg.	48 x 24 x (?)	2cm plaster coat.
W. wall. . .	A3 Irreg.		
Court. . . .	A9 Irreg.		
E. side. . .	X1		'Wavy' wall.
<i>Medamud:</i>			
M.K. wall	—		Level courses.
<i>Thebes:</i>			
Sankhkare chapel	A1 A2 ?	30 x 15 x 9	Brick pylons & walls.
<i>Tod:</i>			
Sesostri I foundations	—	37 x 17 x 12	

69. Bisson de la Roque, F., *Medamoud*, 1929, 9-15.

70. *ibid.*, 13.

71. Petrie, W.M.F., *Queneh*, 4-5 and Pls. IV-VI.

72. Hölscher, U., *E.M.H.*, II, 5.

73. Bisson de la Roque, F., *Tod*, 2.

5. New Kingdom Temples and Chapels.

Eighteenth Dynasty, outside Thebes.

Giza.

Amenhotep II erected at Giza a small chapel⁷⁴ close to the Sphinx, to which he dedicated the building. The walls of the structure are composed of brick with a thin facing of stone, the latter standing in position by its own weight alone, being in no way fixed to the brickwork. An uncommon form of bonding is used in some of the thicker walls, being type A16 of the Corpus, which means that the wall is made up of a central core of unbonded headers contained between two outer "skins" of A2 bonded brickwork. (See Pl.8) At the junction of the outer skin and the core is a very wide joint filled with *tuff*. The advantage of this system may have been that it enabled a thick wall to be built with little trouble, since it was only necessary to take care about bonding at the faces. On the outer surfaces of the walls the bricks are mortared with mud, and their dimensions are 32.5 x 16-17.5 x 10cm throughout the building.⁷⁵

El-Amarna.

As no structural information is recorded about any brickwork in the temples at Gurob or Ehnasya, the next site known to have well-reported brick temples of the Eighteenth Dynasty is El-Amarna, where both the Great and the Small Temple had some elements of this material. In the former building, the enclosure wall of the House of Rejoicing and the pylons were brick-built, and faced both inside and out with stone.⁷⁶ Logs of wood were built into the brickwork to act as ties and solidify the structure. This technique also occurs in the pylons of the Small Temple, with the added refinement that air-passages were provided into the heart of the mass in order to assist drying.⁷⁷ Around the Small Temple was a buttressed temenos wall, the bricks of which were 37 x 19 x 14.5cm in size,⁷⁸ as in the remainder of the temple.

No doubt the temples of this site could have yielded many more interesting constructional features worthy of note, but such subjects are treated very sketchily in the published report. The reason for this is explained in the preface of *City of Akhenaten*, volume III, where we read: "It appears to have been his (Pendlebury's) original intention to include a chapter on architecture and building methods. No draft of such a chapter, or any notes in preparation for it have been found, and it is possible that he changed his mind."⁷⁹

It is indeed unfortunate that the architectural information was not made the subject of a separate study, especially in view of the great variety of buildings available for investigation at the site.

Abydos.

Further work was undertaken in the Eighteenth Dynasty on the site of the Osiris Temple at Abydos, including the reconstruction of part of the temenos wall on the West side by Tuthmosis III.⁸⁰ The bricks of this repair work measure 39 x 22 x 12cm, whilst some earlier bricks found below the base of this wall are of exceptionally large size, averaging 60 x 30.5 x 11.5cm, and presumably dating from the early Eighteenth Dynasty.⁸¹

Also at Abydos are a number of structures erected by Amosis I, all of them built of bricks bearing his prenomen accompanied by the epithet "beloved of Osiris."⁸² The largest building is a terraced temple with a frontage of 120m.⁸³ Each terrace is supported by a retaining wall, the first of these being of brick and the others of stone. The brick wall is formed of two parallel thin walls with a filling of sand between them covered over with bricks to give the appearance of a single wall of great thickness. Buttresses occur along the inside of the "skin" wall to give it stability against the pressure of the internal filling.⁸⁴ This technique of making filled walls has been noted before at the pyramids of Mazghuneh (See Fig.37), and the same process is used in stone masonry in the construction of temple pylons.

Another temple of Amosis I stood one and a half miles south of the temple of Seti I, connected with a large dummy pyramid.⁸⁵ These monuments were built in honour of Queen Tetisheri, and lay on the axis of a nearby shrine dedicated to the same queen.⁸⁶ Little architectural detail is recorded from these buildings, except to say that the bricks were all stamped by Amosis I⁸⁷ and measured 42 x 19 x 14cm in the pyramid temple,⁸⁸ and from 42.5 x 20.5 x 12.5 to 45.5 x 20 x 12.5cm in the shrine.⁸⁹

74. Hassan, S., *The Sphinx and Its History*, 34-42.

75. These details are derived from personal observation.

76. Pendlebury, J.D.S., *City of Akhenaten*, III, 14.

77. *Ibid.*, 92 and Pls. XLVI, 5; XLVII, 1.

78. Pendlebury, J.D.S., *op. cit.*, 92 and Pl. XVI.

79. *Ibid.*, *ibid.*

80. Petrie, W.M.F., *Abydos*, II, 17 and Pl. LVII.

81. *Ibid.*, 50-2.

82. Melver, D.R. & Mace, A.C., *El Amrah and Abydos*, Pl. XXX.

83. Curdell, C.T. & Weigall, A.E.P., *Abydos*, III, 33.

84. Curdell, C.T. & Weigall, A.E.P., *Abydos*, III, 33 & Pl. LIII.

85. Melver & Mace, *op. cit.*, 75-6 & Pl. XXIV.

86. Curdell & Weigall, *op. cit.*, 35-7 & Pls. LI, LXI.

87. *Ibid.*, 35.

88. Melver & Mace, *op. cit.*, 76.

89. Curdell & Weigall, *op. cit.*, 36.

Nubt (Naqada).

The temple of the town of Nubt was rebuilt in the Eighteenth Dynasty above the remains of earlier periods; this reconstruction was accomplished mainly by Tuthmosis III and Amenhotep II, whose names are stamped on the bricks of the pylons and walls.⁹⁰ Probably these brick structures would originally have been overlaid with fine stone to make the building appear to be more lavishly constructed than was in fact the case. The bricks are of typical New Kingdom dimensions, ranging from 38 x 18 x 11.5cm to 40 x 20 x 12cm.⁹¹

Medamud.

The only surviving brickwork of the Eighteenth Dynasty temple is a wall which once marked the extent of the temenos. It is built of bricks measuring 37 x 18 x 14cm, laid in alternate concave and convex sections.⁹² Bricks of identical size and form are used in the Ptolemaic enclosure of the temple, showing that the wall of the Eighteenth Dynasty was the source of materials for the later builders.⁹³

El-Kab.

A number of great brick walls surround the temple of El-Kab, of which the innermost probably dates from the Eighteenth Dynasty.⁹⁴ Little is recorded about this wall, most authors having discussed the much larger outer enclosure, but it is likely that it exhibits the common feature of undulating courses of brickwork. No mention is made of wooden ties or reed layers, which occur so often in walls of this type, but the brick size is stated to be 37 x 18 x 10cm.⁹⁵

Hierakonpolis.

Despite so many finds of archaic date in the temple area, the brick pylons and walls all belong to the reconstruction of the temple in the Eighteenth Dynasty. The size of the bricks at 37 x 19 x 11cm supports this dating⁹⁶ such large dimensions being unheard of in the Archaic Period. It is probable that the walls were cased with stone,⁹⁷ as in the brick temple at Nubt.

SUMMARY: EIGHTEENTH DYNASTY TEMPLES OUTSIDE THEBES

Location	Bonds	Brick Sizes(cm)	Notes
<i>Giza:</i>			
Amenhotep II chapel	A16	32.5 x 16-17.5 x 10	Stone casing on walls.
<i>Gurob:</i>	—	—	Brick temple.
<i>Amarna:</i>			
Gt Temple	—	—	Logs in brick pylons. Stone-faced brickwork.
Small Temple	—	37 x 19 x 14.5	Air channels & timber ties in pylons.
<i>Badari:</i>	A ?	30.5-35.5 long	Brick temple. ⁹⁸
<i>Abydos:</i>			
Tuthmosis III wall	—	39 x 22 x 12 39.5 x 23 x 12.5	
under wall	—	60-1 x 30.5 x 11.5	
Kom es-Sultan	—	32 x 15 x 9.5	
<i>Nubt:</i>	—	38 x 18 x 11.5 to 40 x 20 x 12	Brick walls & pylons.
<i>Medamud:</i>	—	37 x 18 x 14	Enclosure wall.
<i>El-Kab:</i>	—	37 x 18 x 10	Inner temenos wall.
<i>Hierakonpolis:</i>	—	37 x 19 x 11	Brick walls & pylons faced with stone.

90. Petrie, W.M.F., *Naqada and Ballas*, 68 & Pl. LXXXV.

91. *Ibid.*, 66.

92. Bisson de la Roque, F., *Medamoud*, 1928, 10-3.

93. *Ibid.*, 12. 94. Somers Clarke, *JEA* 7 (1921), 63.

95. Stenon, J., *CdE* 25 (1950), 38.

96. Quibell, J.E. & Green, F.W., *Hierakonpolis*, II, 14-5, Pl. LXXII.

97. *Ibid.*, 14.

98. Brunton, G., *Qau and Badari*, I, 18-20 & Pls. XXIII, XXXI.

Eighteenth Dynasty at Thebes.

Karnak.

Brick constructions of the Eighteenth Dynasty occur at the temple of Montu in and around the Ptolemaic enclosure, and especially along its western face, where a series of small chapels have been discovered, of the New Kingdom and later.⁹⁹ In fact, the brick walls of some of these structures pass beneath the later enclosure wall of the temple. This is the case with some remains of an Eighteenth Dynasty building, parts of which have been found on either side of the temenos wall, but only minor traces had survived at each point, and the only detail given concerning the bricks is that they were "large".¹⁰⁰

Further remains of brickwork of this age occur in the north-east part of the enclosure, where the foundations of a girdle-wall of the temple have been discovered.¹⁰¹ This wall employs A3 bonding, and probably encircled a large area to link up with the Eighteenth Dynasty gate whose foundations lie close to the south-west angle of the Ptolemaic enclosure.¹⁰²

*The Mortuary Temple of Tuthmosis III.*¹⁰³

This temple was enclosed by a thick wall of mud brick, plastered on both faces and crowned with an overhanging cornice made of special bricks 38cm high. In the final design, brick pylons were added on the east side. A large number of stamped bricks have been recorded, some stamps being found only in certain parts of the building.¹⁰⁴ (Pl.23-24) The same is true of the different sizes of bricks employed, the bricks in the eastern part of the building being generally larger than those in the western part.¹⁰⁵ Most of the sizes fall into one of three groups: 37-8 x 17-8 x 11-14.5cm, 32-3 x 14.5-16 x 11-2cm and 40-2 x 18-9 x 12-3cm, although a few of the inscribed bricks now in museums are considerably smaller.

The bonding of the pylons and main walls of the temple is A2 or A3, as is usual in thick masses of brickwork, and the courses are strictly level, the horizontal joints being mortared with mud.

Deir el-Medina.

Only two small chapels at Deir el-Medina date from the Eighteenth Dynasty, all the other religious monuments belonging to later periods. The first of these chapels is dedicated to Amenhotep I and Queen Ahmose-Nefertari, and stands outside the North West angle of the Ptolemaic temple-enclosure.¹⁰⁷ Some of the thinner walls of this building are bonded A1, but the brick size is not recorded.¹⁰⁷ In the interior of the rooms the walls were coated with plaster, on which various scenes had been painted.

Within the Ptolemaic temenos stands a chapel built by Tuthmosis III, roofed by brick vaulting,¹⁰⁸ and the interior is decorated with scenes on the plaster covering the walls. In front of the chapel stand pillars of square section, formed of bricks measuring 30 x 15 x 8cm, covered over with white plaster.

The Mortuary Temple of Tuthmosis IV.

This temple was originally enclosed by an encircling wall and had pylons of brick, parts of which still remain on the site.¹⁰⁹ The bricks are laid in A2 or A3 bonding and measure 40 x 19 x 13cm, many examples being stamped with the prenomen of the King. (Pl.26) No reed layers or timber ties are used in the brickwork, and in the core of the walls the vertical joints are very wide and unmortared.

The Mortuary Temple of Ay and Horemheb.

The first two pylons of this temple date from its enlargement under Horemheb; the original structure built by Ay begins at the third pylon. This gateway is formed of bricks measuring 40-2 x 20 x 12cm, many bearing a stamp giving the name of the temple as "The Mansion of *hpr hprw r' r' m3 r't*".¹¹⁰ Bricks with this inscription, and of the same dimensions, occur in other parts of the building, notably the South side of the enclosure wall and in the third court. At some

99. Christophe, L.A., *Karnak-Nord*, III, Pls. VI-VIII & I.

100. *ibid.*, 81.

101. Jacquet, L., *BIFAO* 69 (1971), 268, Pls. XXXII-XXXIII.

102. Christophe, *op. cit.*, 62, Pl. L.

103. Rieke, H., *Der Totentempel Thutmoses III.*, passim. Also Weigall, A.E.P., *ASAE* 7 (1906), 121ff.

104. Rieke, *op. cit.*, 34-6.

105. For details of the exact distribution of the different sizes, see *ibid.*

106. Bruyère, B., *Deir el-Medina*, 1935-40, fasc. 1, 105-6.

107. *ibid.*, Pl. XIX.

108. *ibid.*, 94.

109. Petrie, W.M.F., *Six Temples at Thebes*, 7 and Pl. XXIV.

110. Hölscher, U., *EMLH*, II, 80.

points, however, the bricks are not stamped and are smaller, being 36 x 17 x 12cm in size.¹¹¹ In the East part of the temple, where Horemheb extended the building, the bricks of the first pylon measure 40 x 20 x 12cm, but contain less sand than those used by Ay.¹¹² To compensate for the irregularities of the terrain the whole site had been levelled prior to the construction of the temple, with bricks whose dimensions are 32 x 15 x 8cm.

Medinet Habu.

Around the Small Temple of Medinet Habu are several brick walls of the Eighteenth Dynasty, all but one having been built by Hatshepsut. The earliest walls of her reign run just West of the temple, the outermost being composed of two sizes of brick: 33 x 16 x 9cm and 40 x 19 x 11cm, the latter group bearing stamps of Hatshepsut.¹¹³ Later in her reign the Queen destroyed these structures in order to erect a new wall, 2.70m in thickness, around the temple.¹¹⁴ The bricks in the heart of this wall are 33 x 16 x 9cm in size, whilst those on the faces measure 40 x 19 x 13cm and are frequently stamped.¹¹⁵

The remaining wall of the Eighteenth Dynasty in this area was built by Amenhotep III, whose name occurs on the bricks, and stood to the West of the enclosure of Hatshepsut. This wall was 2.85m thick, and was built of bricks measuring 38 x 18 x 12cm, and although constructed near the temple was not really connected with it.¹¹⁶

The Temple of Amenhotep, son of Hapu.

This temple, standing close to Medinet Habu, is constructed of bricks 40 x 19 x 11cm in size, laid in A1 bonding in the thinner walls and A2 or A3 in the thicker masses of brickwork.¹¹⁷ The outer enclosure wall is not part of the original plan but was added in the Twentieth Dynasty.¹¹⁸ At the rear of the temple, immediately before the three sanctuaries, is a transverse hall which was roofed with a brick vault of 7.70m span,¹¹⁹ making it the largest vault so far known in Egyptian architecture. The bricks of this vault are slightly longer on one side than the other, so that they assume the necessary wedge-shaped form, the actual dimensions being 40 x 19 x 37 x 6cm for the external length, breadth, internal length and thickness respectively.¹²⁰ There can be no doubt that the vault was of type d1, the long, thin bricks being characteristic of this mode of construction. This roofing, and all the other brickwork in the temple, would originally have been coated with whitened plaster.¹²¹

Anonymous Temples near Medinet Habu.

Remains of two small mortuary temples have been found near Medinet Habu, one standing North of the temple of Amenhotep, son of Hapu, and the other to the South.¹²² The North Temple has walls built in A2 or A3 bonding, originally covered with plaster, the bricks measuring 33 x 15 x 9cm and 34 x 16 x 9cm.¹²³ At the South Temple the bonding was A1 and A2 and the size of the bricks was 42 x 21 x 10cm.¹²⁴ These two temples were probably the mortuary chapels of private individuals, grouped behind the huge mortuary temple of Amenhotep III, in the same way as similar chapels were built behind the Great Temple of Medinet Habu.

Nineteenth and Twentieth Dynasties, outside Thebes.

The Delta.

Remains of temples from periods earlier than Saite or Ptolemaic times are notoriously scarce in the Delta, but a few traces of late New Kingdom buildings have been found. At Rotab a new temple-enclosure was constructed in the Twentieth Dynasty, of bricks measuring 47 x 20.5 x 10cm, replacing an earlier wall of smaller bricks.¹²⁵

Petrie found walled enclosures at Heliopolis and Tell el-Yahudieh which he interpreted as Hyksos encampments,¹²⁶ but, as Rieke has argued,¹²⁷ they are more likely to be the temple temenos, built for mythological reasons on a sand mound. In support of the latter view it may be said that the enclosure wall at Tell el-Yahudieh is built in undulating

111. Hölscher, U., *E.M.H.*, II, 60.

112. *ibid.*, 60, 113.

113. *ibid.*, 32.

114. *ibid.*, 32.

115. *ibid.*, 32.

116. *ibid.*, 33.

117. Rubichon, C. & Varille, A., *Amenhotep fils de Hapou*, Pl. V.

118. *ibid.*, 42.3 & Pl. V.

119. *ibid.*, Pl. XI.

120. *ibid.*, 38.

121. *ibid.*, 37.

122. *ibid.*, 41-2, 47. Pls. IV, XIII, XVII.

123. *ibid.*, Pl. XII.

124. *ibid.*, Pl. XVI.

125. Petrie, W.M.F., *Hyksos & Israelite Cities*, 30 & Pl. XXV.

126. *ibid.*, Chapter 1. Also Petrie, *Heliopolis, Kafr Ammar & Shurafa*, 3-4.

127. Rieke, H., *ZAS* 71 (1935), 107-11.

courses of brickwork,¹²⁸ a technique which is not only typically Egyptian, but which is used in Pharaonic times only for temple walls. A number of brick sizes from Tell el-Yahudieh are included in the chart on page 69.

At the nearby site of Tell Da'ba in the North-East Delta remains of a large temple wall of the Twentieth Dynasty have been discovered, built in the usual concave and convex panels, the bricks being 45 x 22 x (?) cm in size.¹²⁹

Memphis.

A small chapel of Ramesses II stands beside the great temple of Ptah at Memphis, and is enclosed on three sides by a brick wall 4m in thickness.¹³⁰ The bonding of this wall is A2 or A3, but no sizes for the bricks are stated. Although the chapel itself was stone-built, the pylon was formed of a mass of brickwork, consisting almost entirely of headers, laid within a thin casing of stone.¹³¹

Hermopolis.

The temple of Thoth at Hermopolis had an enclosure wall dating from the Nineteenth Dynasty which was restored in the Late Period.¹³² In the earlier parts of the wall the bricks are 40 x 14 x 8-9cm in size, whilst some other buildings of the New Kingdom within the temenos have bricks measuring 35-6 x 16-18 x 6-9cm.¹³³

A small temple of Amun, built by Seti II in the great temenos, had a buttressed enclosing wall composed of bricks 40-2 x 22-3 x 7-9cm in size, laid in rather irregular bonding.¹³⁴

Matmar.

A small temple at Matmar was rebuilt by Ramesses II and provided with an outer girdle-wall.¹³⁵ The bricks of this enclosure are of large size, averaging 45 x 20 x 10cm, and are in some cases stamped with the name of the King, with the epithet "beloved of Seth".¹³⁶

Abydos.

Seti I built a girdle-wall around his temple at Abydos, including the Osireion in the enclosed space. The wall is constructed in alternate concave and convex sections and layers of reeds occur between every fourth or fifth course.¹³⁷ Many of the bricks are stamped with the prenomen of Seti, and their average dimensions are 40 x 20 x 14cm.¹³⁸ Along the South and East sides of the enclosure the wall is reinforced by buttresses on the outer face,¹³⁹ and at the rear of the temple it is pierced by a tunnel leading into the Osireion. The arch of this tunnel shows eight rings of brick on the face: the upper three are of ordinary headers and the remaining five are of bricks laid on edge,¹⁴⁰ thereby forming a thick arch of type bc1. An unusual feature is the fact that the bricks of the lower five courses are of the specially thin format normally employed in vaults of inclined rings of brickwork (type d1), but here they are used out of their usual context, laid on edge just as ordinary bricks.¹⁴¹ I know of only one other example of misuse of special bricks in this manner, in the arched gateway of the tomb of Montuemhat at Thebes (q.v. p.51).

The interior of the tunnel at the Osireion is constructed in more usual fashion, consisting of five inclined rings of brickwork,¹⁴² so that this part of the vault is equivalent to type d1 of the Corpus. Special bricks are here used in their correct place for the inclined courses, their dimensions being 46 x 20 x 40 x 7cm. The extra length of one side over the other is due to the brick being slightly curved to suit the curvature of the vault.¹⁴³ Despite this attempt to make the bricks fit perfectly, small flakes of limestone were found necessary to fill the joints in all but the lowest course. The layers of the inclined part of the vault lean alternately 10 degrees to North and South, so that the courses cross each other at an angle of 20 degrees.¹⁴⁴ This technique is also found in the administrative buildings at the Ramesseum, and in Deir el-Medina tomb chapels.

128. Griffith, F.L.I. in Naville, *Mound of the Jew*, 49.

129. Dietrich, M., *MDIK* 23 (1968), 103-4, and 26 (1970), 35.

130. Anthes, R., *Mit Rahineh*, 1956, 54 & Pl. 1.

131. *Ibid.*, 53-4 & Pl. 6, 18 c.

132. Roeder, G., *Hermopolis*, 1929-39, 10.

133. *Ibid.*, 10.

134. *Ibid.*, 10. Also Roeder, *MDIK* 7(1937), Pl. 5.

135. Brunton, G., *Matmar*, 60, Pl. XLV.

136. *Ibid.*, 63, Pl. XLIX.

137. Frankfort, H., *The Cenotaph of Seti I*, 13 and Pl. XIII, 1.

138. *Ibid.*, 13 and Pl. XI, 3.

139. Ghazouli, E., *ASAE* 58 (1964), 111, 156.

140. Frankfort, H., *op. cit.*, 13 and Pl. XIII, 1.

141. Frankfort, H., *op. cit.*, 13-4.

142. *Ibid.*, 14.

143. *Ibid.*, 14. 144. *Ibid.*, 14 and Pl. XI, 4.

SUMMARY: NINETEENTH-TWENTIETH DYNASTY TEMPLES OUTSIDE THEBES.

Location	Bonds	Brick Sizes(cm)	Notes
<i>Rotab:</i>	—	47 x 20.5 x 10	Temple enclosure.
<i>Yahudieh:</i>	—	37-8 x 18-9 x 8-9	Temple enclosure.
		39.5-41 x 18-9 x 11.5	
		44.5 x 16.5 x 11 to	
		45.5 x 21.5 x 11.5	
<i>Tell Da'ba:</i>	—	45 x 22 x (?)	Temple enclosure.
<i>Memphis:</i>	A2 A3	—	Wall around chapel of Ramesses II.
<i>Hermopolis:</i>			
Great enclosure	—	40 x 14 x 8-9	Undulating courses.
In temenos. . . .	—	35 6 x 16-8 x 6-9	
Amun temple			
wall.	Irreg.	40 2 x 22-3 x 7-9	
<i>Matmar:</i>			
Ramesses II			
temple. . . .	—	45 x 20 x 10	Some stamped bricks.
<i>Abydos:</i>			
Seti I temple	—	40 x 20 x 14	Buttressed wall, some stamped bricks.
Arched tunnel	bcl dl	46 x 20 x 40 x 7	Special bricks.

Nineteenth and Twentieth Dynasties within Thebes.

Gurna, Temple of Seti I.¹⁴⁵

Little brickwork is visible at this temple at the present time, the enclosing wall being largely buried under the dumps of earlier excavations. Sufficient could be seen, however, to establish that the bricks of the wall are 40 x 20 x 13cm in size, and are mortared with mud in the horizontal joints.

Deir el-Medina.

A number of chapels and small temples of Nineteenth to Twentieth Dynasty date stand in and around the Ptolemaic temple enclosure at Deir el-Medina. Three chapels are situated within the enclosure, but for one of these no facts are available. The remaining two had pillars of brick in the forecourt and vaulted roofs of type x1 over the inner chambers, all this brickwork being coated with white plaster.¹⁴⁶

Seti I built a small temple to Hathor, North of the later temenos, but all that can be said of this structure is that it was constructed of white-plastered brickwork and had a vaulted sanctuary.¹⁴⁷

Opposite the site of the Ptolemaic temple stand two small monuments of Ramesses II.¹⁴⁸ The more southerly of these is a chapel, originally with vaulted roofs, built of re-used bricks of the Eighteenth Dynasty, some of which were stamped with the name of Tutmosis IV and measured 35 x 20 x 11cm.¹⁴⁹ Slightly further North, the second building of Ramesses II is a small temple to Amun, the brick walls of which are coated with both plain and decorative plaster.¹⁵¹

Another brick chapel of Ramesses II stands to the North of the Ptolemaic temple, but no structural information is recorded save for the fact that wooden roofing was employed.¹⁵² Close to this structure is a Twentieth Dynasty chapel, known as Chapel G,¹⁵³ in which bricks of varying size occur. Those of the naos measure 30-1 x 16-7 x 9-10cm, whilst elsewhere they are 40 x 20 x 12cm, except in the pylon, where the size is 30-2 x 14-15 x 8-9cm. As in certain other chapels at Deir el-Medina, the walls of this building were decorated with painted plaster.

145. *PM*, II, 207ff.

146. Bruyère, B., *Deir el-Medinet*, 1935-40, fasc. 1, 92-6.

147. *ibid.*, 99-106 & Pl. 10.

148. *ibid.*, 120-4.

149. *ibid.*, 120.

150. *ibid.*, 121-4.

151. *ibid.*, Pl. 11.

152. Bruyère, B., *Deir el-Medinet*, 1945-7, 18.

153. *ibid.*, 21-7.

Medinet Habu.

The Great Girdle Wall of the temple of Ramesses III is between 10 and 11 metres thick at its base, where it is founded on the rock, and is preserved to a height of 15.20m.¹⁵⁴ Originally the wall had small towers and a crenellated top and parapet, but these have disappeared. The face of the wall has a slight batter, produced in some parts by stepping the brickwork back slightly at each course, but in others by laying the bricks at right-angles to the slope of the face.¹⁵⁵ The latter method makes the courses assume the form of a concave arc through the thickness of the wall, as shown in Fig.38. On the outer face all the joints are pointed with mud, but in the internal work no mortar whatsoever was employed, thereby making the central part of the courses 1–2cm thinner than the peripheries. To compensate for this difference, which becomes cumulative, bricks are laid on their ends about every sixth course, raising the level by 8 or 9cm.¹⁵⁶ In some parts

Fig.38 Section of Girdle-Wall at Medinet Habu.



of the wall, reeds were placed between every second course of bricks.¹⁵⁷ The bonding is of type A2 or A3, which also occurs in the outer wall of the temple-area. Both the Great Wall and the outer wall are built of bricks measuring 43 x 21 x 13cm.¹⁵⁸

The more immediate surroundings of the temple were encircled by another wall, known as the Inner Enclosure Wall,¹⁵⁹ which was six metres thick and had a sloping socle 1.70m high. Towers were built along the face at intervals of about 45m, extending 3.80m beyond the wall. The foundations are better than usual in Egyptian building, and go down to a depth of 2m, whilst all the exposed brickwork was white-plastered.

One of the cross-walls in the precincts of the temple ran close to the older temple of Hatshepsut, and in fact overlaid one of the Eighteenth Dynasty walls around that building.¹⁶⁰ Ramesses III built a brick pylon in his wall to allow access to the Small Temple, the bricks of this construction being 43 x 20 x 14cm in size, although re-used bricks bearing the stamps of Amenhotep III and Ay also occur in the Twentieth Dynasty monuments of Medinet Habu.¹⁶¹

6. Temples of the Twenty-First to Thirtieth Dynasties.

The Delta.

The most extensive remains of this age in the Delta are found at Tanis, where a group of large enclosures surround the various temples. The earliest of these great walls was constructed by Psusennes I around the Great Temple, and subsequently another wall, of larger extent, was erected by Sheshonk III (Pl.39). Montet argued,¹⁶² at least in his earlier works, that the larger enclosure was to be dated to Ramesses II; later he revised this opinion¹⁶³ to say that the wall replaced that of Psusennes, but still insisted that the original layout had been the inspiration of Ramesses II. This is extremely unlikely, as has been pointed out by Van Seters,¹⁶⁴ and the presence of foundation sacrifices beneath the wall would tend to indicate a later date, especially since sacrifices of similar form occurred beneath the wall of Psusennes.¹⁶⁵ I see no reason why the whole of the large enclosure should not be ascribed to Sheshonk III, who also constructed the granite pylon entrance through its West side.¹⁶⁶

Turning now to the structure of these walls, we will first consider the smaller temenos of Psusennes. There is no doubt as to the date of this wall, since the bricks are all stamped with the name of the Pharaoh.¹⁶⁷ The bricks measure 46 x 25.5 x 15.5cm, and, contrary to the usual practice in temple-enclosures, are laid in level courses. Layers of reeds occur in some of the horizontal joints, and at heights of 3.60 and 4.35m are two white lines where white plaster has been used as a mortar.¹⁶⁸

154. Hölscher, U., *E.M.H.*, IV, 1.

155. *ibid.*, 3.

156. *ibid.*, 3.

157. Hölscher, U., *E.M.H.*, IV, 3, note 8.

158. *ibid.*, 3.

159. *ibid.*, III, 61.

160. *ibid.*, II, 33.

161. *ibid.*, II, 33 and vol. IV, 29.

162. Montet, P., *Tanis*, 55. Also Fougerousse, J.L., *Kemi* 5 (1935-6), 19-48.

163. Montet, P., *Les Enigmes de Tanis*, 14-21 & Fig. 1.

164. Van Seters, J., *The Hyksos*, 128-30.

165. Fougerousse, J.L., *Kemi* 5 (1935-6), 40.

166. Montet, P., *Les Enigmes de Tanis*, 15 & Fig. 1.

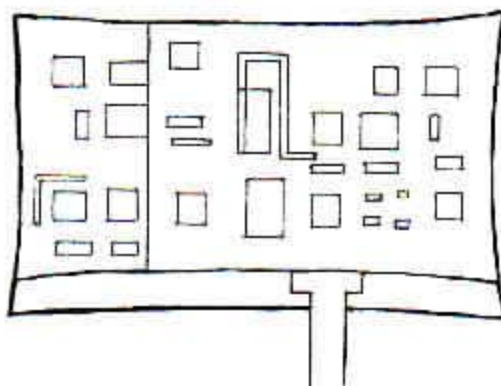
167. Petrie, W.M.F., *Tanis*, I, 19.

168. Fougerousse, J.L., *Kemi* 5 (1935-6), 29-31 & Pl. III.

The outer enclosure¹⁶⁹ is built in undulating courses, the concave sections projecting on the face beyond those which are convex. Wooden beams are laid in rows through the mass of brickwork, to act as aids to stability. This vast enclosure, its sides measuring 300 x 400m, is 17m thick and composed of millions of bricks, the dimensions of which are 40 x 19 x 13cm and 41-2 x 21-2 x 14cm.

Within the temenos is a building which Montet referred to as "L'Edifice en Briques Crues".¹⁷⁰ This structure, which has never been satisfactorily explained, is probably of Twenty-First or Twenty-Second Dynasty date, since foundation sacrifices similar to those beneath the enclosure walls of the temple were found under its corners.¹⁷¹ It consists of a large block of brickwork containing a number of compartments, and was apparently built in two sections, the Western part being formed of large bricks with reed bonding, and the Eastern part of smaller bricks without reed layers.¹⁷² The exterior walls have alternate courses of headers and stretchers laid on a concave bed, whilst the angles have the form of bonding usually associated with A10 bonding.¹⁷³ A ramp ascends to the top of the facade from the direction of the Great Temple.¹⁷⁴ This is an important point, for it shows that the surviving remains are but the platform upon which some building was constructed, whose entrance lay at the top of this ramp. Once we realize that we are dealing with only the foundations several other features of the building are explained, such as the absence of any doors between the internal chambers, and the almost total lack of any occupation debris in the rooms.¹⁷⁵ The compartments in the brickwork were most probably intended to be filled up with gravel or sand to form a level platform upon which to construct a building of some kind, perhaps, in view of the alignment of the ramp towards the Great Temple, some form of small peripteral chapel, whose elevated situation on this podium-like foundation would be entirely in keeping with Egyptian religious beliefs (Fig.39).

Fig.39 Brick Foundation-Platform at Tanis.



This is not the only example of this type of foundation, similar cellular platforms with gravel-filled compartments having been found at North Saqqara and Medamud,¹⁷⁶ although in the latter case its true nature was not recognised.

One other brick construction at Tanis is worthy of mention, this being the enclosure wall of the temple of Anta. No structural information is available, but a stela found at the site¹⁷⁷ shows that the wall was rebuilt by Amasis, this being probably the latest reconstruction of the enclosure.

Brickwork of the reign of Amasis occurs also at Mendes, in the foundations of the temple.¹⁷⁸ It was the usual practice in Late times to dig out deep foundations, line the excavated area with a brick retaining wall, and fill it up with sand. Consequently the great rectangle of brick which contained the foundation sand is often found in the exploration of ruined temples of this period, as in this case at Mendes. It consists of a wall 2.60m thick, enclosing an area of 29.4 x 26.6m, with the inner face supported by buttresses at intervals.¹⁷⁹

At Naukratis the Great Temenos consisted of a wall built of bricks measuring 41.5 x 21 x 11cm, preserved to a height of nine metres in some places.¹⁸⁰ In the nearby temenos of Apollo at this site, Petrie found decorative rosettes carved in stone, which he considered were set into the brickwork around the gateway of the enclosure.¹⁸¹

The temple at Gemaiyem¹⁸² was surrounded by a wall approximately 8m in thickness, built of bricks measuring 47 x 23.5 x (?)cm. Most of the bricks were laid as headers, but near the base a few courses were set at an oblique angle, as in A17 bonding. All of the East wall had been rebuilt in Ptolemaic times with bricks of 40.5 x 20.5 x (?)cm format,¹⁸³ whilst the original structure may belong to the Twenty-Sixth Dynasty. The gate had also been repaired at a later date, the bricks in this case being 35 x 18 x (?)cm in size.¹⁸⁴ Within the temenos a whole series of buildings had

169. *ibid.*, 32-4 & Pl. IX.

170. Montet, P. et al., *Les Nouvelles Fouilles de Tanis*, 76-88, &

171. *ibid.*, 78-9 & Pl. XXXVIII. Pls. XXXV-XXXVI.

172. *ibid.*, 82-3.

173. *ibid.*, Pl. XXXVII.

174. *ibid.*, 80.

175. *ibid.*, 84.

176. See below Pp. 72, 79.

177. Montet, P., *Kemf* 8 (1942), Pls. V-VI.

178. *JARCE* 6 (1967), 6-7 and Pl. 11.

179. *ibid.*, 6 & Pl. IX, fig. 7.

180. Petrie, W.M.F., *Naukratis*, I, 24, 26.

181. Petrie, W.M.F., *Naukratis*, I, 15.

182. Petrie, W.M.F., & Griffith, F.L.L., *Tanis*, II, 38-9 & Pl. XXI.

183. *ibid.*, 38.

184. *ibid.*, 38.

been constructed, varying in date from Saite to Ptolemaic times, the dimensions of the bricks being larger in the earlier structures than in those of later periods.¹⁸⁵ Of the temple itself, only the sand-filled foundation was discovered, comprising a rectangle of brick walls measuring 34 x 21m, built of large bricks 43 x 21.5 x (?)cm in size.¹⁸⁶ A similar foundation was found at Nebesheh, also of Saite date, the bricks in this case being of 45.5 x 22.5 x 13cm format.¹⁸⁷

A few details from other Delta sites are included in the summary on page 76.

Saqqara.

In the Northern part of the site of Saqqara a temple built by Nekhthorheb has been discovered,¹⁸⁸ dedicated to Isis, mother of the Apis. This building stood upon an elevated platform of gravel, held in place by a thick retaining wall.¹⁸⁹ Entry to the temple was gained by means of a ramp on the West side, formed of sand-filling between two side-walls, paved over with bricks 38-39cm in length. Against the outer face of the West wall of the temple-platform a great buttress has been constructed to counteract the thrust of the gravel filling of the enclosure.¹⁹⁰ The sloping face of the buttress is produced by stepping the brickwork back a little at each course, and then coating the exterior surface with a thick layer of plaster.

The enclosure wall of the temple area is built in separate panels of brickwork,¹⁹¹ but with the alternate concave and level courses showing only on the outer face, being a simplified form of this manner of building. In the centre of the West wall, at the point where the ramp stood, is a gateway¹⁹² which, although now open, was blocked with brickwork when first excavated. This gate, which was probably to allow easy access to the enclosure during the construction of the temple, has well-built jambs with all the visible joints mortared, and with irregularly spaced wooden ties set into the brickwork. The ordered rows of logs seen in other temple walls do not occur at this site.

Within the enclosed area stand the remains of the temple itself, consisting of brick-built shrines and pylons, the exterior surfaces of which were originally overlaid with a thin limestone casing. The bonding used in these constructions is generally A2 or A3, the bricks being set in mud mortar, whilst in the walls of the main shrine layers of reeds are found between the courses of bricks. In one of the pylons to the West of the shrines there are holes which mark the places where logs have been built in, although these appear to be rather haphazardly distributed. The sizes of bricks used in the temple and its enclosure wall are given in the table on page 76.¹⁹³

A short distance to the South of the temple of Nectanebo lie the ruins of several buildings of both domestic and religious nature.¹⁹⁴ Some of these structures are the foundations of small stone-built chapels which originally stood in this area, and are composed of squarish blocks of brickwork divided up by cross-walls into internal compartments. There are no doors between these chambers, since they were intended to be filled up solid with gravel to provide a level platform upon which the stone building could be erected.¹⁹⁵ The constructions labelled by the excavators as "Blocks 1, 4 and 7"¹⁹⁶ each include cellular foundations of this type, and the differences in plan between them suggest that each was adapted to the layout of the building which it supported, so that the greatest weight would fall on to the most solid masses of brickwork. Part of Block 7 was made up of solid brickwork, seven courses of which remain, at a point where presumably there was considerable pressure from above. Most of the walls in these foundations are bonded A1, A2 or A3, but in the West wall of Block 4, A10 bonding is used. This is an interesting system in which a course of stretchers in the thickness of the wall is shifted in position from one course to the next. (See Pl. 5) Some use is also made of bond A12, which is basically the same as A2, except that a very wide gravel-filled joint is created in the middle of the wall (Pl. 6). Reeds were employed between the brick courses in Blocks 1 and 7, where the mortar was composed of mud, whilst in Block 4 it was formed of *tafl*. In Block 1 a buttress had been built against the West wall, to resist the pressure of the internal filling, which, as the site slopes from East to West, would be greatest at this point.

Close beside these ruined foundations stands a small temple, which has been considered to be of non-Egyptian origin. The brickwork of this building is poorly constructed, most of the walls being made up of irregularly laid bricks, although some A2 bonding occurs in the internal cross-walls. In the chart on page 76 the brick sizes found in this temple, and in the structures described above, are listed.

185. *ibid.*, 39, 45 & Pl. XXI.

186. *ibid.*, 39.

187. *ibid.*, 14.

188. Emery, W.B., *JEA* 55 (1969), 34 & Pl. X.

189. Emery, W.B., *JEA* 55 (1969), 34 and *JEA* 56 (1970), 11, Pls. III, XI.

190. Emery, W.B., *JEA* 53 (1967), 144-5 & Pl. XXI, 3. Also *JEA* 56 (1970), Pl. XI, 3.

191. Emery, W.B., *JEA* 57 (1971), Pl. I.

192. Emery, W.B., *JEA* 56 (1970), 11.

193. For the structural details of all the Late Period brickwork at this site, see the chapter by A.J. Spencer on the brick architecture, in the final report of the recent excavations by the Egypt Exploration Society (Forthcoming).

194. Martin, G.T., *JEA* 59 (1973), 7, 11.

195. *ibid.*, 7, 11. Also Emery, W.B., *JEA* 57 (1971), 9.

196. See n. 193 above.

197. Martin, G.T., *JEA* 59 (1973), 8-11 & Pls. I-IV.

On the opposite side of the desert plateau of North Saqqara, to the East of the pyramid of Teti, there stand other remains of Late Period religious architecture in the form of several great walls of brick (Pl.48A). These originally enclosed a small temple which stood at this point, at the lower end of the processional route to the Serapeum. A cornice block from the temple bore the name of Ptolemy V,¹⁹⁸ but, as Quibell remarks,¹⁹⁹ the building may well have been in existence from an earlier time. The characteristics of the brick walls are very similar to the brickwork of the Thirtieth Dynasty at Saqqara, and, considering the fact that the temple at the Serapeum and the sphinx lined avenue leading to it were works of Nectanebo II, it may be that the same Pharaoh was responsible for the initial construction of the lower temple.

The walls exhibit alternate panels of concave and level beds of brickwork, are built of bricks measuring 38-9 x 18-9 x 12cm, and have layers of reeds between every second course.²⁰⁰ Large beams of timber were set into the walls in rows, several courses apart, to improve the stability of the construction.²⁰¹ Mud-mortar is used in the joints on the outer faces, but any mortaring of the internal work is rough or non-existent.

Hermopolis.

The enclosure wall of the temple area was rebuilt in the Thirtieth Dynasty, in the usual fashion of undulating courses of brickwork.²⁰² Most of the bricks measured 40 x 20-2 x 14-5cm, but some were smaller, with dimensions of 37-40 x 16-7 x 12cm. In the sections of the wall examined, the horizontal joints were filled with a sandy mortar.²⁰³

Karnak.

(i) Montu temple.

Remains have been found of an enclosure wall around the temple of Montu, dating from some period after the Twenty-First Dynasty and prior to the reign of Achoris.²⁰⁴ Sections of this wall have been traced on the site in the North East area of the temenos, and also immediately North of the gate of Ptah of the Amun temple-enclosure.²⁰⁵ (Pl.40). In both of these locations the wall is built in A3 bonding, and is protected at the base by a row of oblong plaques of burnt brick, set on edge, resting against the wall face.²⁰⁶

(ii) Amun temple.

The most important monument to be considered here is the great girdle-wall around the temple precincts (Pl.40). This is most likely to be a work of Nectanebo I, since a stela of his from Karnak records that he constructed a new enclosure wall (*shby*) around the temple of Amun.²⁰⁷ The wall exhibits the technique of separate panels of brickwork and undulating courses in its most complete form, as is illustrated in Plates 48B-49A. The reasons why temple walls were built in this manner are discussed in Chapter 9.

The original face of the great wall,²⁰⁸ where preserved, shows an alternation of header and stretcher courses, but where the brickwork has scaled away the interior is seen to consist entirely of headers, with bricks on edge here and there to adjust the levels. Mud mortar fills the horizontal joints on the face, but in the mass of brickwork the mortaring is roughly done, and is confined to the horizontal interstices. Layers of reeds occur between every second course of brick, and rows of wooden ties are set into the wall at intervals. At the North-East corner of the enclosure these logs are thirteen courses apart, and separated by the width of three headers horizontally, but at other points they can occur at an interval of nine courses. Air-channels, two bricks high by half a brick wide, penetrate into the heart of the wall from the face, so as to dry the interior.²⁰⁹ On the North side of the enclosure some of these channels are well-preserved, each one being placed at a distance of twelve stretcher-lengths from the next (Pl.49). It is a feature of walls built in undulating courses, at least in good examples like this, that where the courses are concave along the line of the wall they are at the same time convex in section across it, and the converse is also true.²¹⁰ At the angles of the projecting concave sections the form of corner bond employed is that commonly found with A10 bonding (Pl.5). There is no doubt that the whole of the temenos wall was built at one time and as a single work, since the same characteristics are found in all parts of it, and the bricks everywhere are in the size range of 36-7 x 17-18.5 x 12-4cm.

198. Quibell, J.E., *Excavations at Saqqara*, 1905-6, 29 & Pl. XXXI, 5.

199. *Ibid.*, 29.

200. *Ibid.*, 14 & Pls. VII-VIII.

201. *Ibid.*, 14 & Pl. VII.

202. Roeder, G., *Hermopolis*, 1929-39, 10, 31-4, & Pl. 29.

203. Roeder, G., *Hermopolis*, 1929-39, 10.

204. Jacquet, J., *BIFAO* 69 (1971), 269, Plan I & Pls. XXXII-XXXIII.

205. Christophe, L., *Karnak-Nord*, III, 62 & Pls. XXV-XXVI.

206. *Ibid.*, 63 & Pl. XXV and Jacquet, *op. cit.*, 269.

207. Habachi, L., *Kemé*, 20 (1970), 229ff.

208. The structural details of the wall are derived from personal observation on the site.

209. Engelbach, R., *Ancient Egyptian Masonry*, 210.

210. Chuisy, A., *L'Art de Bâtir chez les Egyptiens*, 22-3.

The temple of Amun had a number of earlier enclosure walls before the building of that of Nectanebo I, but only one of these is preserved on the site, the others being known from literary evidence.²¹¹ The surviving wall extends to the North and South from the gateway of the temple of Amun, Hearer of Prayers, in the East part of the temenos (Pl.50). Immediately on either side of the gate of this temple the wall assumes the form of a pylon,²¹² the bricks being laid in A2 or A3 bonding without reed layers or wooden ties. At this point the wall overlies an earlier one, the remains of which can be traced at its base. Probably the earlier wall is the work of Ramesses II, who built at this small temple, and the brickwork which now stands over it is a later reconstruction. This is supported by the presence of one or two burnt bricks built into the wall. From the North side of the temple the remains of an enclosure wall²¹³ continue for a fair distance in alternate sections of concave and level beds of brickwork. In the foundations of this wall is a stone block bearing the cartouches of Ramesses II, set upside down in the brickwork, proving the wall to date from a period after his reign (Pl.50A). The most likely date for the wall I would suggest to be the Twenty-Fifth Dynasty, at which time numerous other works were carried out at Karnak. The presence of burnt bricks does not necessarily indicate work of the Roman age, since burnt brick was employed by Taharqa in his building beside the Sacred Lake.²¹⁴ One air-channel similar to those in the wall of Nectanebo I, survives in the earlier wall, and is visible on Pl.50A. The bricks are 41 x 25 x 12-4cm in size,²¹⁵ but in the area close to the gate of the temple of Ramesses II they measure 35 x 17 x 12cm.

Within the enclosure of the Great Temple of Amun are a number of small buildings in which brickwork is employed. In the East zone of the temenos is an unusual structure of burnt brick, built by Necho, whose cartouches are stamped on the bricks.²¹⁶ The building consists of tunnels roofed by d1 vaults, with side-walls of rough A1 bond. Leclant states the size of the bricks to be 28 x 14 x 5.5cm,²¹⁷ and although some may have these dimensions, all the examples which I measured were 33 x 15 x 7-8cm in size. The use of burnt brick is interesting, since prior to the Roman period this material was only used in places subject to excessive wear or damp. I suspect that its use here indicates that the entire building was originally covered by an earth mound, or group of mounds, being intended to represent the tomb of Osiris,²¹⁸ to whom the North-Eastern part of Karnak was dedicated.

Few details of brickwork in other small chapels in the Eastern area of the temenos are given in the table on page 77.²¹⁹

To the North of the temple of Amun lies a chapel of Amasis and Nitocris,²²⁰ partly brick-built but with stone used for door sills and jambs. The brick walls of this structure are built in A2 or A3 bonding with bricks 31 x 15.5 x 10cm in size.

Luxor.

From the face of the pylon, on the West side, a wall extends to the North, turns to the East, and then turns again towards the temple, thereby enclosing the area immediately in front of the pylon²²¹ (Fig.40). In the North wall of the enclosure is a gate leading to the avenue of sphinxes which continues to Karnak.²²² The wall is built in alternate level and concave beds of brickwork, mostly of mud-bricks, but with a number of later repairs in red burnt brick.²²³

There is no reason to doubt that the original mud-brick wall was constructed by Nectanebo I, who also built the gateway and the sphinx avenue.²²⁴ The wall is built of bricks measuring 35-6 x 17 x 12-3cm, laid in A2 or A3 bonding with mud mortared joints. At the North-West corner are five courses of stone blocks on the outer face,²²⁵ resting on the brickwork, one of the blocks being a re-used column-drum of Seti II. These stones occur in a section of the wall with concave courses, and they lie at the same angle as do the bricks. The use of stone at the angles of this type is seen also at Edfu.²²⁶ No traces of reed layers or timber ties are visible in the wall at Luxor.

Along the avenue of sphinxes to Karnak were rows of trees, planted in pits in the ground. Each pit is lined with brick and irrigation channels of the same material run from one pit to the next.²²⁷

211. Barquet, *Le Temple d'Amon-Re à Karnak*, 33-9 & Plan 1.

212. Leclant, J., *Orientalia*, 22 (1953), 86.

213. See Redford, D.B., *JEA* 59 (1973), 28-9.

214. Chevrier, H., *ASAE* 50 (1950), 436.

215. Some examples noted by Redford were 38 x 21 x 18 cm. See *op. cit.*, 29.

216. Chevrier, H., *op. cit.*, 438-9 & Pls. V, XI.

217. Leclant, J., *Orientalia* 20 (1951), 459.

218. See Robichon, C. & Varille, A., *Temple primitif de Médamoud*, 15-20.

219. See Redford, D.B., *JEA* 59 (1973), 16-30.

220. *PM*, II, 192 and Plans VI, XVI, 1.

221. Leclant, J., *Orientalia* 19 (1950), 362 & Pl. XXXIII.

222. *ibid.*, 362. Abdel-Razik, M., *MDIK* 23 (1968),

156-9, Pl. XLIII a.

223. Leclant, *op. cit.*, 362 & Pl. XXXIV, 5. Also Abdel-Mohammed, M., *ASAE* 60 (1968), 237.

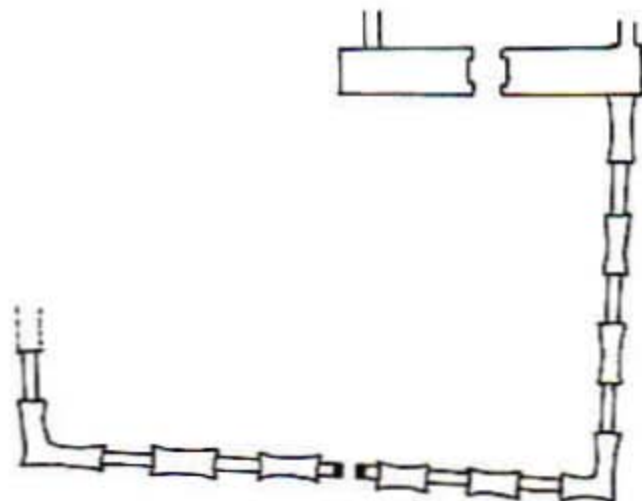
224. Abdel-Razik, M., *MDIK* 23 (1968), 156-9.

225. Leclant, J., *Orientalia* 19 (1950), 362 & Pl. XXXIII.

226. Chassinat, E., *Le Mammisi d'Edfu*, II, Pl. LXX.

227. Abdel-Razik, M., *MDIK* 23 (1968), Pl. XLVII a.

Fig.40 The Enclosure Wall at Luxor.



Medinet Habu.

A new wall was built in the Twenty-Fifth Dynasty around the Small Temple of Medinet Habu, over the destroyed enclosure of Hatshepsut. The bricks, measuring 44 x 21 x 14cm, are stamped with a cartouche surmounted by two plumes, but in every case the stamp had been so carelessly applied that the inscription was illegible, although the excavators thought that they could discern the name of Taharqa.²²⁸ This is quite likely, since a stela of that king from Medinet Habu records that he restored the wall of the temple.²²⁹ Lepsius found a brick of Shabaka in this area,²³⁰ so possibly the enclosure was built by Shabaka and restored under Taharqa. The South wall of the temenos may have been repaired again at a later date, since the bricks in this part were unstamped and measured 41 x 20 x 12cm.²³¹ An outer enclosure wall was added to the temple at this period, in addition to the wall described above, with bricks 38 x 18 x 9cm in size.²³²

El-Kab.

Of the three walls which surround the temples of El-Kab, the two outer ones seem to be contemporaneous, both dating from the time of Nectanebo I whose cartouches appear on the gateways²³³ in the wall labelled B on the plan (Pl.39). The bricks in the Great Wall (A) are most frequently 39 x 19.5 x 15cm in size, although some examples measure 38 x 19—20 x 12.5cm.²³⁴ In wall B the size of 39 x 19.5 x 15cm also occurs, but at some points the dimensions reach 42 x 19 x 10cm.²³⁵ With regard to this wall it is only possible to say that it is built in the usual panels and undulating courses of brickwork,²³⁶ but much more detail is available concerning the structure of the Great Wall. Parts of this enclosure are built in true undulating courses, whilst other sections have alternate concave and level panels of brickwork, but omit the convex courses.²³⁷ At many points the apparently separate panels are not divided by a clean joint through the mass, but are bonded together and must have been constructed at one time.²³⁸ Logs of wood occur in the Great Wall, laid both along and across the wall every fourteenth course, and reed matting was used between the layers of bricks.²³⁹ On the North, East and South sides there are ramps to the top of the wall, the bricks being laid on a slope at the angle of the ramp. Consequently the ramps are not bonded with the wall, but are merely built up against it.²⁴⁰ Stairs are found close to these ramps, built in the thickness of the brickwork and ascending to the summit.²⁴¹ The front edge of each step is protected from wear by a wooden beam, all the rest of the stair being constructed in mud-brick.²⁴² Gateways were built in the sides of the enclosure, and one example in the North wall still preserves its arched roof, consisting of an arch of type cd1, four courses thick.²⁴³ The arch was built over earth centring, much of which still remains in position, since the gate was never used, and was later blocked with brickwork on its outer face.²⁴⁴

Also at El-Kab is a peripteral temple,²⁴⁵ (X on Pl.39) built on a cellular brick foundation of concave courses of brickwork, thereby illustrating the purpose of these gravel-filled platforms at other sites. (See pp. 71, 72, 79)

228. Hölscher, U., *E.M.H.*, II, 34.

229. *Ibid.*, 34.

230. *L.D.T.* III, 165.

231. Hölscher, U., *op. cit.*, 35.

232. Hölscher, U., *E.M.H.*, II, 38.

233. Somers Clarke, *JEA* 7 (1921), 64.

234. Stienon, J., *CdE* 25 (1950), 38.

235. *Ibid.*, 38.

236. Somers Clarke, *JEA* 7 (1921), 64.

237. *Ibid.*, 74 & Pls. XV-XVIII.

238. *Ibid.*, 77.

239. *Ibid.*, 76 & Pl. XV.

240. *Ibid.*, 66, 78 & Pl. XVIII.

241. *Ibid.*, 77 & Pl. IX.

242. Somers Clarke, *JEA* 7 (1921), 77.

243. *Ibid.*, 68 & Pl. XIII.

244. *Ibid.*, 69.

245. Capart, J. et al., *Fouilles de El-Kab*, 35 & Pl. 37.

SUMMARY: TEMPLES OF THE TWENTY-FIRST TO THIRTIETH DYNASTIES

Location	Bonds	Brick Sizes(cm)	Notes
<i>Tanis:</i>	—	46 x 25.5 x 15.5	Psusennes wall.
	—	40 x 19 x 13	Sheshonk III wall.
<i>Naukratis:</i>	—	41.5 x 21 x 11	
Gt Temenos	—	45.5 x 22.5 x 13	Foundations of temple.
<i>Nebesheh:</i>	—		
<i>Gematyemi:</i>	—	47 x 23.5 x (?)	Dyn. XXVI.
Enclosure	—	40.5 x 20.5 x (?)	Later repairs.
	—	35 x 18 x (?)	
Foundations	—	43 x 21.5 x (?)	
<i>Behbeit:</i>	—		
Enclosure ²⁴⁶	—	40 x 17-8 x 12	
<i>Sais:</i> ²⁴⁷	—	44 x 20.5 x 12.5	
<i>Kom Afrin:</i>	—		
Enclosure	—	42 x 19 x 11.5	
<i>Saft:</i>	—		
Enclosure	—	38 x 20 x 12.5	Outer temenos wall is over 20m thick
<i>Buto:</i>	—		
<i>Kom el-Hiss:</i> ²⁴⁸	—	46 x 23 x (?)	
<i>Saqqara:</i>			
Nectanebo II enclosure	A3	36.5-38 x 18 x 10-2	Simple 'wavy' courses.
Shrines	A2 A3	41-2 x 20-1 x 12	Stone casing.
		37.5-38 x 18 x 11	
Block 1	A2 A3	40-1 x 20-1 x 11	Reeds in brickwork.
		38 x 18.5 x 12	
Block 4	A10 A3	36-7 x 17-8 x 12.5-13.5	
"Foreign Temple"			
(Block 5)	A2 A1 & Irreg.	30-1 x 15 x 13-4	
Block 7	A2 A3 A12	37-8 x 18 x 12	Reeds in brickwork.
		38.5 x 19 x 12	
		40 x 19 x 12-3	
Walls E. of Teti pyr.	A3	38-9 x 18-9 x 12	Reeds every 2nd. course. 'Wavy' courses
<i>Kafr Ammar:</i> ²⁴⁹	—	—	Brick temple of Dyn. XXV.
<i>Hermopolis:</i>	—		
Enclosure	—	40 x 20-2 x 14-5	'Wavy' courses. Sandy mortar.
	—	37-40 x 16-7 x 12	
<i>Karnak:</i>			
Montu temple,	—		
Late Period wall	—	—	Wall faced with burnt brick plaques at base.
Amun temple,	—		
Great wall	—	36-7 x 17-18.5 x 12-4	Reeds every 2nd. course. 'Wavy' courses
	—		Logs & air-channels.
	—		Air-channels in wall.
XXVth.? Dyn. wall	—	41 x 15 x 12-4	Burnt bricks with stamps of Nectanebo
Building of Necho	d1	28 x 14 x 5.5	
Wall W. of Osiris		33 x 15 x 7-8	
<i>hḥ-jt</i> temple		38 x 19 x 12	

246. Lézine, A., *Kemi* 10 (1949), 51.

247. Petrie, W.M.F., *Naukratis*, I, 89. The details from Kom Afrin and Saft are also derived from this reference.

248. Griffith, F.L., *Naukratis*, II, 77.

249. Petrie, W.M.F., *Hermopolis. Kafr Ammar & Shurafa*, 37, Pls. XXXV-VI.

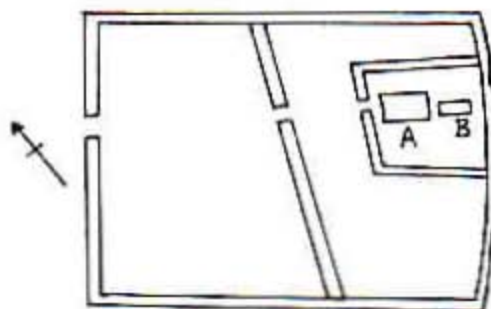
Location	Bonds	Brick Sizes(cm)	Notes
Wall W. of last	—	37 x 18 x 11	
S. of temple	—	30 x 15.5 x 10.5	
Shrine of Shepenupet	—	32 x 17.5 x 9	
Takeloth shrine	—	—	Burnt Brick used.
Amasis & Nitocris shrine	—	31 x 15.5 x 10	
<i>Luxor:</i>			
Enclosure	—	35-6 x 17 x 12-3	Concave & level beds.
<i>Medinet Habu:</i>			
Dyn. XXV wall	—	44 x 21 x 14	Bricks of Taharqa.
Repairs	—	41 x 20 x 12	Dyn. XXX.
Outer wall	—	38 x 18 x 9	
<i>El-Kab:</i>			
Great Wall	—	39 x 19.5 x 15	'Wavy' courses. Reeds & Logs used.
Arch at gate	c1	—	Arch of 4 courses, over earth centring.
2nd. encl. wall	—	39 x 19.5 x 15	'Wavy' courses.
		42 x 19 x 10	

7. Ptolemaic and Roman Religious Architecture.

Tukh el-Qaramus.

The temple enclosure at Tukh el-Qaramus is built upon a sand mound, as at Tell el-Yahudieh and Heliopolis, and is composed of the walls shown in Fig. 41. All sides of the outer enclosure were originally built of bricks measuring 35.5 x 18 x (?) cm, but later repairs were carried out on the South-West side with larger bricks whose dimensions are 38 x 19 x (?) cm.²⁵⁰ Outside the North-East wall the sand bank was retained by bricks 40.5 x 20.5 x (?) cm in size.²⁵¹ No structural details are recorded about the cross-wall which divides the enclosed area, nor about the smaller girdle wall which surrounded the temples in the South-East part of the temenos. Within this small enclosure stand the foundations of the temple itself, formed of great beds of sand held in place by brick retaining walls.²⁵² (Fig. 41, A and B) Both of the foundation platforms are built of bricks measuring 38 x 19 x 12.5 cm, and they are dated by foundation deposits to the reign of Philip Arrhidaeus.²⁵³ It is worth noting that the outer girdle-wall was built in separate panels of brickwork,²⁵⁴ which means that it almost certainly also exhibits the characteristic undulation in the courses of the bricks, although this is not specifically stated in the report.

Fig. 41 The Temple-Walls at Tukh el-Qaramus.



Memphis.

Part of the enclosure wall of the temple of Ptah has been excavated, and found to consist of alternate concave and level beds of brickwork, using bricks of a 42 x 21 x 11.5 cm format.²⁵⁵ No wooden ties were used in this wall, and no mention is made of the presence of reed layers between the courses of bricks. The date of the enclosure, although not certain, would seem to fall in the late Ptolemaic or the Roman period.²⁵⁶

250. Griffith, F. L., in Naville, E., *Mound of the Jew*, 54 & Pl. IX.

251. *ibid.*, 54.

252. *ibid.*, 55. 253. *ibid.*, 55.

254. *ibid.*, 54.

255. Anthes, K., *Mit Rahineh*, 1955, 12-3 & Pls. 7-9.

256. *ibid.*, 1956, 31-2.

The Fayum.

A number of brick-built temples were constructed at various sites in the Fayum during the development of the area by the Ptolemies. At Tebtunis the temple enclosure-wall is built in sections, according to the Egyptian tradition, and is 3.50m in thickness,²⁵⁷ whilst at Bacchias stood a temple whose exterior walls were three metres thick, formed of small bricks, except for a few larger ones, measuring 38 x 15 x 12cm, in the East wall.²⁵⁸ The temple of Philadelphia is brick-built except for the door-jambs, which are of stone, and has wooden beams laid in the thickness of the brick walls.²⁵⁹ At Theadelphia these strengthening beams are set both along and across the walls,²⁶⁰ as occurs in Ptolemaic and Roman town houses (Fig. 42). One wall of this temple has been plastered in such a way as to imitate the appearance of a wall of well-laid stone. The bricks of this building are 24-5cm long, except in some of the internal walls where brick 23cm in length occurs.²⁶¹

Fig. 42 Timbering in wall, Theadelphia temple.

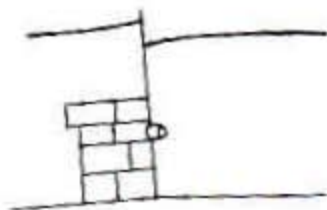


Dendera.

Prior to the construction of the great Ptolemaic temple at Dendera, earlier temples had existed on the same site from the Middle Kingdom, if not before.²⁶² In the Twenty-Fifth Dynasty, the old girdle-wall of the temple, which was of less extent than the later enclosure, was repaired by Shabaka.²⁶³ The early wall is probably to be identified with two sections of brickwork still existing on the site, one South-West of the sacred lake and the other to the East of the Ptolemaic temple,²⁶⁴ both of these sections being built with the undulating courses of bricks which are typical of temple walls.²⁶⁵

The outer enclosure was probably built in late Ptolemaic times, concurrent with the erection of the stone temple.²⁶⁶ However, any Ptolemaic brickwork is completely masked by the latest restoration of the enclosure, which is recorded on a Greek stela from the site to have been completed in the ninth year of Tiberius.²⁶⁷ Consequently, the wall as it stands today is entirely Roman in date, disrupted in places by later constructions. The Roman wall displays undulating courses, and has the appearance of being built in separate panels of brickwork,²⁶⁸ although probably these were all erected at the same time (Pl. 51 A). In some parts the face of the wall is well-preserved, and reveals the presence of channels²⁶⁹ leading into the mass of the structure, whilst timber ties are visible just West of the Propylon.²⁷⁰ Arches through the wall occur on the North and West sides of the enclosure, built in *cl* bonding and five courses in thickness. At certain points the projecting angles of the concave sections of brickwork are reinforced by a casing of stone, a feature also noted at Luxor and Edfu. The best example of this technique is found on the outer face of the wall, just to the West of the Propylon; and some disturbed blocks of stone lying to the North of the East Gate, again outside the wall, may come from a similar usage at this point.²⁷² In the former location, the third course of stone has a round projection set out from its corner, as shown in the drawing below.

Fig. 43 Stone courses at angles of wall, Dendera.



The meaning of these stone courses will be fully explained in Chapter 9, but it can be stated briefly that they are analogous to the reinforcement of the corners of mud-brick houses by wooden beams, and to the occurrence of stone bricks in the angles of the brick pyramids of New Kingdom tombs at Thebes.²⁷³

257. *CdE* 7 (1932), 87.

258. Grenfell, B.P. et al., *Fayum Towns and their Papyri*, 36.

259. Zucker, F., *Archäologischer Anzeiger*, 1909, 179-86.

260. Lefebvre, G., *ASAE* 10 (1910), 167-8 & Pl. IV A.

261. *Ibid.*, 167-8.

262. Daumas, F., *Dendera et le Temple d'Hathor*, 1-4.

263. *Ibid.*, 4.

264. *Ibid.*, 5.

265. Chassinat, E., *Dendera*, I, Pls. XXV, XXX.

266. Daumas, F., *op. cit.*, 5.

267. Aime-Giron, N., *ASAE* 26 (1926), 109-112.

268. Chassinat, E., *op. cit.*, Pls. VI, XIV, XL.

269. *Ibid.*, Pl. XV.

270. *Ibid.*, Pl. V.

271. *Ibid.*, Pls. III & XIX.

272. Chassinat, E., *Dendera*, I, Pls. IV, IX.

273. Borchardt, L., *ZAS* 70 (1934), 25-35.

Diospolis Parva (Hu).

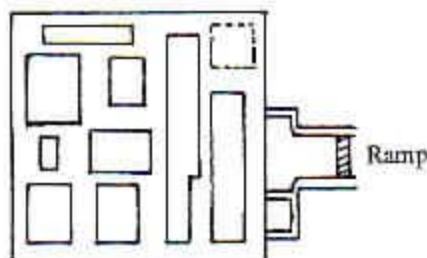
The temple enclosure at this site was altered to form a fortress in Roman times, the original wall being of Ptolemaic date.²⁷⁴ On the East side of the temenos is a structure of well-laid brickwork, which Petrie stated to be the foundation of some building.²⁷⁵ It is roughly square in shape, built of bricks measuring 37 x 18.5 x 14cm,²⁷⁶ and has internal compartments without interconnecting doorways. Probably it is another example of a gravel-filled cellular foundation, of the same type as those of Saqqara (see above, page 72).

Medamud.

The Ptolemaic enclosure wall of the temple of Madamud is built in undulating courses, but entirely of re-used bricks of the Eighteenth Dynasty.²⁷⁷ Another wall of the same type in the East part of the temenos, which may have formed the enclosure around the temple of the Sacred Bull, is also of re-used brick.²⁷⁸

More interesting is a structure in the temple area which the excavators thought might be a storehouse.²⁷⁹ This is unlikely since it does not conform to the type of temple-storerooms found at the Ramesseum or Medinet Habu, and, more significantly, there are not doors between the internal chambers (Fig.44). A ramp approach²⁸⁰ to the building reveals its true nature, showing it to be a foundation for some structure, and not a building in itself. This is almost certainly another example of a foundation-platform formed of gravel-filled compartments in a block of brickwork, and the fact that the only objects found in any of the chambers were a few later potsherds²⁸¹ supports this view. The bricks throughout the building were 37 x 18 x 14cm in size.²⁸²

Fig.44 Brick Foundations at Medamud, plan.



Karnak.

The surviving brick wall around the temple of Montu at Karnak is of Ptolemaic date, at least in the section close to the North-East corner.²⁸³ It is built in A3 bonding, with some irregularities and many edger-headers for levelling, and exhibits alternate sections of convex and concave brickwork. Wooden ties were built into the structure at various levels; most of these beams run across the wall, but a few are laid longitudinally.²⁸⁴ The bricks measure 36-8 x 18.5 x 12-14cm and are laid in mud mortar with pointed joints on the face of the wall, but more roughly in the internal work. A detailed examination of the North-West angle revealed the rather irregular corner bonding, and the fact that no reed-matting was used between the courses of bricks.²⁸⁵

Immediately outside the Great Temple of Amun, before the South wing of the pylon, stands a small chapel of Roman date, built almost entirely of burnt brick.²⁸⁶ The walls of this building are bonded C3 and are mortared with lime. Also of Roman age is a thick wall²⁸⁷ of mud-bricks which runs between the Temple of Amun and the small temple of Ramesses II in the East part of the enclosure, this wall being constructed of bricks 31 x 14-15 x 9-11cm in size, in a combination of Class A and Class C bonding.

At the temple of Mut there is more brickwork of Ptolemaic or Roman date.²⁸⁸ The main girdle-wall of the temenos is built in undulating courses of bricks, probably in A2 or A3 bonding, with many bricks on edge for levelling. There is no sign of wooden ties or reed layers in the wall, but the face is extremely weathered, and it may be that these

274. Petrie, W.M.F., *Diospolis Parva*, 54-5 & Pl. XXIV.

275. *ibid.*, 55-6 & Pl. XXIV.

276. *ibid.*, 55.

277. Bisson de la Roque, F., *Médamoud*, 1928, 8, 12.

278. *ibid.*, 13-6.

279. *ibid.*, 1927, 10.

280. *ibid.*, 1927, 11.

281. *ibid.*, 1927, 9.

282. *ibid.*, 1927, 10.

283. Jacquet, J., *BIFAO* 69 (1971), 271.

284. Christophe, L.A., *Karnak-Nord*, III, 5-6.

285. Christophe, L.A., *Karnak-Nord*, III, Pls. XVII-XX.

286. Lauffray, J. et al., *Kem* 20 (1970), 71, Fig. 5.

287. Barguet, P., *ASAE* 50 (1950), 280.

288. Details from personal observation.

features are hidden by the decay of the bricks. The weathering made it difficult to obtain the size of the bricks, although the measurements could be taken from the well-preserved core of the wall if excavations were conducted here. Some examples on the inner face of the North wall had dimensions of 39 x 18 x (?) cm.

Nearer to the temple on the East and South sides is a wall of mud- and burnt-bricks, the latter being used in the lower courses. The burnt bricks are 31 x 15-16 x 8 cm in size, and are probably of the Roman age, although they could be earlier.

Luxor.

The enclosure wall of Nectanebo I in front of the pylon of the Luxor temple was repaired in Roman times with mud-bricks 33 x 15.5-16 x 7 cm in size, mortared with lime. These repairs are visible at several points around the wall and are built in A1 or C1 bonding.²⁸⁹ On the West side of the enclosed area stands a small Roman chapel, constructed of mud- and burnt-bricks, the walls of which were originally stuccoed to imitate the appearance of marble slabs.²⁹⁰

Deir el-Medina.

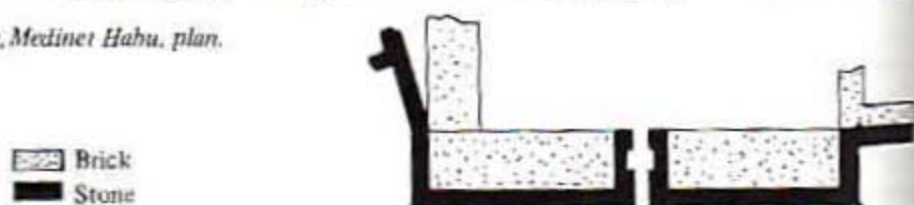
The Ptolemaic temple of Deir el-Medina is founded on a sand bed contained within brick retaining walls, as is usual in late temple foundations.²⁹¹ Around the temple is a great enclosing wall built in undulating courses of brickwork, with traces of white plaster on the surfaces. (Pl. 51B) This wall is preserved in some places to its full height, and has rounded crenellations at the top. One section of the North wall collapsed anciently and was restored by the Romans, the C3 bonding of the repair²⁹² being a distinct contrast to the A3 bonding of the Ptolemaic brickwork. No wooden beams or reed matting seem to have been included in the structure of the wall. The bricks are of moderate size, measuring 29-32 x 14-5 x 4-10 cm, and they are laid in mud-mortar.

The brick-built Mammisi²⁹³ stands against the South side of the stone temple, to which it is linked by a vault over the outer room. This vault, sprung from the stonework of the temple, is of type cd1, two courses in thickness, and made use of thin, grooved bricks 20 cm wide. It follows a fairly low curve, and must have required some form of centring for its construction. The brick walls of the Mammisi are built in Class A bonding, and were originally covered with whitewash plaster.

Medinet Habu.

A wall 3.50 m in thickness was constructed in Ptolemaic times in front of the Small Temple, with a new pylon on the East side.²⁹⁴ The wall stands on a sloping socle and is built of bricks which range in size from 38 x 18 x 11 cm to 40 x 19 x 11 cm.²⁹⁵ A stone facing was applied to the facade of the brick pylon, but on the inner side the brickwork was merely plastered over. Practically all the bricks of the pylon were laid as headers (Fig. 45). The Romans added a

Fig. 45 Ptolemaic pylon, Medinet Habu, plan.



wall around this temple, but the only fact recorded about this is the brick size of 35 x 17 x 8 cm.²⁹⁶ Repairs were made to the wall of the Twenty-Fifth Dynasty, west of the temple, in Coptic times, with bricks measuring only 25 x 12 x 5 cm.²⁹⁷

289. Razik, M.A., *MDIK* 23 (1968), Pl. XLIII, b.

290. Mohammed, M.A.Q., *ASAE* 60 (1965), 239-40.

291. Brayère, B., *Deir el-Medinet*, 1935-40, fasc. 1, 57.

292. *ibid.*, 55.

293. *ibid.*, 65 & Pls. VII-VIII.

294. Hölzl, U., *EMH*, II, 29-30, 36-7.

295. *ibid.*, 36.

296. *ibid.*, 37-8.

297. *ibid.*, 38.

Armant.

The only brickwork of note at the temple of Armant is the Roman enclosure wall, built in the traditional wavy courses and faced with stone at the base.²⁹⁸ The bonding of the wall is A18,²⁹⁹ an arrangement which is not extensively used until very late times, and the bricks measure 30.5–35.5 x 15–18 x 9.5–11.5cm.³⁰⁰

Tod.

The girdle-wall of the temple area, which is ascribed to Ptolemaic times, is nine metres in thickness and built of bricks 38 x 18 x 11cm in size.³⁰¹ Probably it exhibits the usual undulation of the brick courses, although this is not specifically stated in the report.

Edfu.

Around the Temple of Horus there was a great temenos wall, of which only a small part is preserved. Choisy stated³⁰² that in this wall the lower courses are laid horizontally, whilst at a higher level they are laid in alternate level and concave sections, and this is in fact the case.³⁰³ This method of construction is a further simplification of the technique of laying bricks in undulating courses. At the South-West angle of the wall, four courses of stone are built into the corner at a high level,³⁰⁴ in similar fashion to the stones employed in the wall of Nectanebo I at Luxor. (See above, page 74). The face of the wall shows alternate layers of headers and stretchers, with bricks on edge here and there to adjust the levels.³⁰⁵

Kom Ombos.

The enclosure wall of the Ptolemaic temple is built in sections in which the bricks are laid alternately in a convex and concave arc, and, according to Choisy,³⁰⁶ is bonded A3, with occasional courses laid at an oblique angle, as in bond A17. The outer face of the wall seems originally to have been covered with a layer of whitened mud-plaster.³⁰⁷

Elephantine.

An enclosure wall of brick surrounds the temple of Khnum at this site, built in undulating courses in their full form. Type A10 corner-bonding is used at the angles of the projecting concave sections,³⁰⁸ whilst in the thickness of the wall the bond is A3, with a few irregularities.³⁰⁹ Wooden beams are laid transversely through the brickwork at the eighth course from the base, and thereafter at every tenth course,³¹⁰ and layers of reeds occur.

The date of this wall is not certain, but it must belong to a late epoch. It has been ascribed to the Ptolemaic period,³¹¹ but Riecke has suggested that it may in fact be of Roman date, in which case it would link up with the Roman pylon of the temple.³¹² In support of the latter view, it may be noted that the wall has structural similarities to the Roman enclosure at Dendera.

The Western Oases.

A considerable number of brick-built temples of Roman date stand in and around the great oases of the Western desert of Egypt, but very little information is available about these buildings. A few items of structural interest are listed in the summary chart below.³¹³

298. Mond, R. & Myers, O.H., *Temples of Armant*, 13.
299. *Ibid.*, 13.
300. Engelbach, R., *Ancient Egyptian Masonry*, 210.
301. Bisson de la Roque, F., *Tod.*, 2.
302. Choisy, A., *L'Art de Bâtir chez les Égyptiens*, 25.
303. Chassinat, G., *Edfu*, 14, Pl. DCLXX.
304. Chassinat, E., *Le Mammisi d'Edfu*, II, Pl. LXI.
305. *Ibid.*, Pl. LXI.

306. Choisy, A., *op. cit.*, 16.
307. *Ibid.*, Pl. IX.
308. Honroth, W. et al., *ZAS* 46 (1909), 36-7, Pl. VII-VIII.
309. Kaiser, W. et al., *MDIK* 27 (1971), Pl. XLVII.
310. Honroth, W., *ZAS* 46 (1909), 37, 41 & Pl. VII.
311. *Ibid.*, 43.
312. Riecke, H. & Sauneron, S., *Elephantine*, 33.
313. Information from Winlock, H.E., *Ed-Dakkeh Oasis*.

SUMMARY: BRICKWORK IN GRAECO-ROMAN TEMPLES

Location	Bonds	Brick Sizes(cm)	Notes
<i>Tukh el-Qaramus:</i>	—	35.5 x 18 x (?) 38 x 19 x (?) 38 x 19 x 12.5	Enclosure wall. Repairs. Foundation walls.
<i>Memphis:</i>			
Ptah temple wall	—	42 x 21 x 11.5	'Wavy' courses.
<i>Bacchias:</i>			
Brick temple	—	38 x 15 x 12	Most bricks smaller.
<i>Philadelphia:</i>	—	—	Brick temple with stone doors.
	—	—	Timber in walls.
<i>Theadelphia</i>	—	24–5cm long.	Brick temple. Timbered walls.
	—	—	Plaster "fake" of stonework.
<i>Dendera:</i>			
Dyn. XXV wall	—	—	'Wavy' courses.
Roman wall	—	—	'Wavy' courses, logs, air-channels.
	—	—	Stone at angles.
<i>Diospolis:</i>	—	—	'Wavy' girdle-wall.
	—	37 x 18.5 x 14	Brick foundations.
<i>Medamud:</i>			
Enclosure	—	—	'Wavy' courses.
Foundations	—	37 x 18 x 14	Cellular platform.
<i>Karnak:</i>			
Montu enclosure	A3	36–8 x 18 x 12–4	'Wavy' courses, logs, mud-mortar.
Roman chapel	C3	—	Burnt brick construction.
(by Pylon 1)			
Wall E. of Amun Temple	A3 C?	31 x 14–5 x 9–11	Mostly mud-bricks.
Mut temple enclosure	A2 or A3	39 x 18 x (?)	'Wavy' courses.
Wall E. & S. of temple	—	31 x 15–6 x 8	Burnt brick lower courses.
<i>Luxor:</i>			
Repairs to enclosure	A1 C1	33 x 15.5–16 x 7	Burnt bricks.
<i>Deir el-Medina:</i>			
Enclosure	A2 or A3	29–32 x 14–5 x 9–10	'Wavy' courses. Crenellated top.
Repairs	C3	29–30 x 15 x 6–7	Level courses. Roman date.
Mammisi	—	—	Vault over outer room, type cd.
<i>Medinet Habu:</i>			
Ptol. wall	—	38 x 18 x 11 to 40 x 19 x 11	Brick pylon cased with stone.
	—	35 x 17 x 8	
Roman wall	—	—	
<i>Armant:</i>			
Enclosure	A17	30.5 x 15 x 9.5 to 35.5 x 18 x 11.5	Stone facing at base.
	—	—	'Wavy' courses.
<i>Tod:</i>	—	38 x 18 x 11	Ptolemaic wall.
<i>Edfu:</i>			
Enclosure	—	—	Alternate level/concave beds in levels only. Stone courses at S.W.
<i>Kom Ombo:</i>	A3 & Irreg.	—	'Wavy' courses.
<i>Elephantine:</i>			
Enclosure	A3	35 x 17 x 12	'Wavy' courses, logs & reeds.
<i>Dakhleh Oasis:</i>			
Deir el-Hagar	—	—	Small brick temple. Columns of bricks, each making 1/5th. circle.
	—	40 x 20 x 12	Enclosure of temple.
<i>Ain Amur</i>	—	—	
<i>Tenideh:</i>			
Brick temples	—	—	White-plastered walls and pylons. Some vaulted roofing.
<i>Kharga Oasis:</i>			
Brick temples	—	—	

CHAPTER SIX: ADMINISTRATIVE AND OFFICIAL BUILDINGS

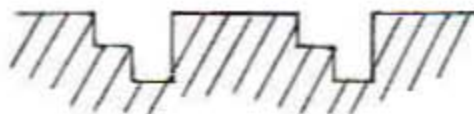
1. Archaic Period

The Early Palace of Hierakonpolis

A report has been published on this early building at Hierakonpolis,¹ which, in view of its importance, is worthy of a brief description here.

The portion of the structure so far excavated comprises a large gateway in a brick wall, decorated with palace-facade panelling. The bricks, which measure 24.5 x 12 x 6cm, are bonded A1, with the occasional use of half-bricks in the construction of the niches. By the style of the large recesses, it is possible to date the building to the early part of the First Dynasty, although some unusual "half-niches" occur, of the form shown in the drawing below. This kind of niche is not known elsewhere in palace-facade brickwork, but it may only be due to careless work, or to a desire to reduce the length of the wall.

Fig. 45X Unusual Type of Niche,
Early Palace of Hierakonpolis.



The Abydos Enclosures

Although it now seems certain that the structures which were once thought to be forts at Abydos had a funerary purpose,² connected with the Protodynastic tombs of Umm el-Qa'ab, I have included them under this heading since, in the present state of our knowledge, they cannot happily be classified with either tombs or temples. Only the well-preserved monuments of the Second Dynasty are included in this study, since it is from these that structural information can be obtained.

The large enclosure of Khasekhemui, now known as Shunet ez-Zebib, consists of a wall 5.40m thick and 11m high, built on a rectangular plan.³ Along the outer face of the wall are the remains of palace facade niches, those on the East side being more complex than the others.⁴ Where the face of the brickwork has scaled away the interior is seen to consist almost entirely of headers, as is common in very thick walls, and the bonding of the whole structure would probably have been A3, with bricks on edge in places to adjust the levels of individual courses. A coat of whitened mud-plaster covered all the brickwork, on both the inside and outside of the wall, to an average thickness of 2cm,⁵ and the bricks themselves are 25.5 to 27cm in length.⁶ The whole building was surrounded by an outer wall with plain surfaces, which is preserved to a height of six metres in some places.⁷

Of the other two buildings of similar form at the site little can be said. The monument of Peribsen had plastered niches on the main wall,⁸ as in the Shuneh, but no trace of such panelling is preserved on the enclosure now occupied by a Coptic community.⁹

2. Middle Kingdom Official buildings

As no buildings have been found from the Old Kingdom to which an official purpose can be assigned, it is in the Middle Kingdom that the next group of monuments of this class is encountered. Within Egypt itself examples are extremely scarce at this period, but I have added here some details from the administrative buildings which are found within the fortresses of Nubia. The only Middle Kingdom official buildings which I have been able to find in Egypt are a block of brick structures on the East of the pyramid of Amenemhat III at Dashur,¹⁰ comprising a number of rooms, some of which had coloured plaster on their walls. On the West side of the block is a vaulted corridor, roofed with a cd1 arch, and paved with headers.¹¹

1. Weeks, K., *JARCE* 9 (1971-2), 29 and Plan at end.

2. Kemp, B.J., *JEA* 52 (1966), 13-22.

3. Currelly, C.T., Ayrton, E.R. & Weigall, A.E.P., *Abydos*, III, 3 & Pl. VI.

4. *Ibid.*, 2 & Pl. V.

5. *Ibid.*, 2-3 & Pl. V, 4.

6. Petrie, W.M.F., *Tombs of the Courtiers & Oxyrhynchos*, 4.

7. Currelly, *op. cit.*, 3.

8. *Ibid.*, 2 & Pl. VII.

9. Currelly, C.T., Ayrton, E.R. & Weigall, A.E.P., *Abydos*, III, 3.

10. De Morgan, J., *Fouilles à Dashour*, 1894-5, 100.

11. *Ibid.*, 100-101.

From Nubia come numerous examples of administrative buildings, in the Middle Kingdom fortresses of the region. At Mirgissa these mud-brick constructions had wooden columns to support the roofs, and the walls were decorated with coloured plaster.¹² The floors were usually composed of plastered brick, but in an unroofed part of Room 32 burnt brick tiles were employed. Such tiles also occur at Buhen and Shalfak for the paving of the streets, the examples from the latter site being 30 x 30 x 5 cm in size.¹³ A drain in the centre of the street at Buhen shows that the burnt brick was chosen because of its resistance to water, despite the infrequency of rain in Nubia, although the material would also better stand the passage of traffic.

At Uronarti and Shalfak, the buildings commonly have vertical timbers set at their corners, to protect the brickwork. Not far from the fort at Uronarti there was a palace¹⁴ containing seventy rooms, some of which contained square brick foundations for columns, but the precise date of this building is unknown.

3. New Kingdom Official Buildings

Memphis

A palace belonging to Merenptah has been excavated at this site,¹⁵ but little has been published about the structure of the building. Stone was used for the doorjambs and lintels, but the majority of the construction was composed of mud-brick, covered over with plaster. In the antechamber was a floor composed of even rows of bricks, the dimensions of the latter being 39 x 19 x 8 cm.

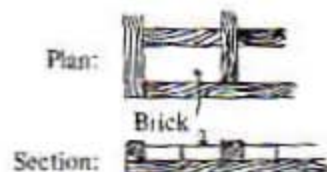
Hermopolis

Attached to the temple of Amun at this site was a small palace of Seti II,¹⁷ which had walls built in A1, A2 and A3 bonding and may originally have been roofed with brick vaults. The floors of the rooms within this palace were all paved with square mud-brick tiles, measuring 40 x 40 cm, covered over with a thin layer of plaster.¹⁸

Amarna

Unfortunately no structural information is available about the palaces at El-Amarna, but a number of other buildings which are more or less official in nature can be described. The area of gardens, known as Meru-aten,¹⁹ was originally enclosed by a buttressed wall, which was probably decorated with painted designs. In this district is the structure called the Water Court,²⁰ consisting of a series of pools with columns between them. These tanks are lined with mud-brick, and the pillars, which are of the same material, are strengthened by having beams of wood set in the brickwork.²¹ Of the two pillars beside the first pool at the East end of the hall, one had three beams built into it at ground level, whilst the other was a complete framework of wood, as shown in Fig. 46.

Fig. 46 Beams in Brick Pillar, Meru-aten.



In the Dependencies of the temple are some storehouses, of which the only structural detail noted is the use of two columns of special bricks, built around a central wooden post.²² The outer surface of the columns was coated with a layer of plaster, which had been moulded into a fluted form. Unfortunately, the shape of the special bricks used in these columns is not described, and the same is true of other bricks used in circular piers in the Military Quarters.²³ At the latter point, brick piers were employed in many buildings²⁴ to support the roof, being presumably an economical substitute for wooden columns. Floors of mud or brick were found in the Military Quarters,²⁵ and one room in a house attached to the Police Barracks had paving slabs of sun-dried mud, measuring 35 x 38.5 cm.²⁶

12. Dunham, D., *Second Cataract Forts*, II, 144-5, 148.

13. *Ibid.*, 119.

14. *Ibid.*, 21, 121.

15. *Ibid.*, 22-30.

16. Fisher, C., *PMJ* 8 (Dec. 1917), 211ff. & 15 (June, 1924), 92ff.

17. Roeder, G., *MDIK* 7 (1937), 21-2 & Pl. 5a, Plan 1.

18. *Ibid.*, 22.

19. Peet, T. L., & Woolley, L., *City of Akhenaten*, I, 104.

20. *Ibid.*, 118-9 & Pl. XXXVII. Pl. XXXIX.

21. Peet, T. L., & Woolley, L., *City of Akhenaten*, I, 119.

22. Pendlebury, J. D. S., *City of Akhenaten*, III, 22.

23. *Ibid.*, 132.

24. *Ibid.*, 131-2 & Pl. LI, 3-5.

25. *Ibid.*, 131-4. 26. *Ibid.*, 134 & Pl. LIV, 1.

The Bridge²⁷ over the Royal Road was supported on two massive piers, strengthened with great baulks of timber in the brickwork. One of these beams was 5m long and 60cm square in section, although others were smaller, being of 30cm square section and 3m long.

The Desert Altars,²⁸ which were probably connected with the Northern Tombs, can be included in this section. These were brick-built structures approached by means of ramps, the latter being formed of two parallel walls with sand-filling between them, which must originally have been paved over with brickwork. Sand-filling was also used beneath the paving of the altars themselves. The Southern Altar was different from the others in having an alternation of thick walls and rows of brick piers from the facade to the centre.²⁹ Probably the outer wall of this building was faced with stone, as the ramp approaches do not touch the facade.³⁰

Abydos

On the South of the temple of Seti I at this site are a series of storehouses, formed of long vaulted tunnels like those at the Ramesseum. The buildings all stand in the area between the temple and its enclosure wall, on a site which has been artificially levelled with debris.³¹ At the entrance to the storehouses is a square building which has been mistaken for a palace, but is in fact no more than an administrative department, controlling the passage of goods to and from the stores.³² Behind this entrance hall are two corridors, 39m in length and 6.6 to 6.8m wide, from which access to the store-tunnels is obtained.³³ The walls of these two corridors, and of the administrative building, were decorated with coloured plaster, whilst in the store-tunnels white plaster was used. Each of the tunnels is 37.5m long, and the width varies from 3.5 to 6m.³⁴ The walls are built of bricks measuring 40 x 20 x 14.5cm, and the floors throughout the building are formed of square slabs of mud-brick, 44 x 44 x 16cm in size.³⁵ For roofing the long passages, brick vaults of type d1 were used, in exactly the same manner as at the Ramesseum. The bricks of the vaults measured 60 x 22 x 7.5cm, and had been trimmed on the underside to give a smooth curve.³⁶ On top of this roof, the ridges between the vaults had been made level by filling up the depressions with bricks.³⁷

Thebes

I. The Ramesseum.

The palace of Ramesses II at his mortuary temple³⁸ was mainly brick-built, with stone used for the doorjambs, lintels, columns and architraves. As in the palace of Ramesses III at Medinet Habu, the roofing was formed of brick vaults, but these have not survived. Most of the walls are bonded A2 or A3, and the bricks are 42 x 20 x 10cm in size.

Also at the Ramesseum are a series of brick storehouses, grouped around the temple.³⁹ These buildings have been the subject of a number of earlier studies, although the only drawing of any accuracy is that given by Lepsius.⁴⁰ The same scholar collected a number of stamped bricks from these structures, some of which bear the cartouche *Wsr-m3et-Rr* without the epithet *stp-n-Rr*, and date from the co-regency or from the first year of Ramesses' sole reign (Pl.32). The individual buildings are described below according to their location. (See plan, Pl.45).

Northern Group.⁴¹

On the North of the temple are two storehouses, consisting of brick-built passages 3.20 and 3.70m in width, with stone jambs and sills at the doorways. The bricks are 40 x 20 x 13–14cm in size⁴² and they are mortared with mud.

Southern Group.⁴³

Some rooms in these buildings were of fairly large size and presumably had wooden roofing, but the store-tunnels themselves were vaulted. The details of the brickwork here are the same as in the Northern storehouses.

27. *Ibid.*, 56 & Pl. XXXIX, 1.

28. Frankfort, H. & Pendlebury, J.D.S., *City of Akhenaten*, II, 101-2.

Also Petrie, W.M.F., *Tell el-Amarna*, 5 & Pl. XLII.

29. Frankfort, H. & Pendlebury, J.D.S., *op. cit.*, 101 & Pl. XXVI.

30. *Ibid.*, 101.

31. Ghazouli, E., *ASAE* 58 (1964), 111, 156.

32. *Ibid.*, 109ff. & Pl. V.

33. *Ibid.*, 145.

34. *Ibid.*, 111, 144, & Pls. XV-XVI, XIX-XXII.

35. *Ibid.*, 144, 156, 158, & Pl. XVI B.

36. *Ibid.*, 144 & Pl. XII B.

37. Ghazouli, E., *ASAE* 58 (1964), 145 & Pl. XVI A.

38. Hölscher, U., *EMH*, III, 77-8.

39. *Ibid.*, 78-82 & Pl. 10.

40. *L.D.*, I, 89.

41. Hölscher, U., *EMH*, III, 80.

42. Hölscher, in *EMH*, III, 80, gives a brick size of 38 x 18 x 11cm to 39 x 19 x 13cm for all the store-rooms of the Ramesseum, and some of the bricks certainly do fall in this range. However, the measurement of many examples on the site showed that bricks 40cm long were very common, and consequently I have used my own measurements in the text.

43. Hölscher, U., *EMH*, III, 80-1.

Western Group.⁴⁴

Three separate stores stand on the West of the temple, the central one being the oldest. This building has an entrance hall containing four inscribed stone columns, which supported a roof of three parallel vaults, and stone is further employed for the doorjambs and thresholds. From a vaulted central corridor access is gained into the store-tunnels, which are 3.70m in width and 3.80m high. Holes in the roof were left every 6m, for the purpose of emptying grain into the stores. The bricks of the vaults are 35 x 21 x 6-7cm in size,⁴⁵ whilst those of the side-walls measure 40 x 20 x 12-14cm. Some of the passages have large brick-built jambs at the entrances (Fig. 47), which are constructed in A1 bonding throughout, whilst the side-walls are bonded A2 or A3, with some irregularities. At the angles of the walls the corner bond is that illustrated in the Corpus with A10 bonding, on Plate 5.

Fig. 47 Brick Doorjambs in Stores, Ramessesum.

Schematic plan.



The storehouse at the North-West corner of the temenos was entered from a wide street, in which there was a colonnade along the front of the building. This street was paved with square bricks, 40 x 40cm in size. The vaults, which are well preserved in this area, are 3.70m wide and 4.50m high, and have apertures in the roof for filling every 6.30m. In the centre of the building is a long hall with two rows of columns, which probably supported a roof composed of three vaults. All the vaulting in this building, and everywhere at the Ramessesum, is of the d1 type, four courses in thickness, with the alternate courses leaning in opposing directions, as occurs in the Nineteenth Dynasty magazines at Amara West.⁴⁷ The details of the vaults are shown in Plates 53A-B, where the grooves scored on the bricks can be seen. The interior of the roofing is coated with plaster to a thickness of 10cm, as are the walls of the passages. On their face these walls have the appearance of C1 bonding for the lower 12 courses, and A1 above, but behind this neat exterior the internal work is extremely irregular, as shown in Plate 53A. Choisy suggested⁴⁸ that the use of bricks on edge, which is not common at this period, had a decorative purpose, but this is impossible since the plaster coat would have hidden the brickwork from view. The bricks in these walls measure 39-40 x 17-18 x 10cm, and in the outer North wall of the building they are 38-9 x 18 x 12-13cm.

At the South-West corner of the temple-enclosure is another magazine,⁴⁹ with an entrance hall, central corridor and storerooms, all of which were covered by vaulted roofs, in some instances with a six-metre span. Stone was used in the building for paving the floor, and for lining the walls to a height of 75cm.

II. The Funerary Temple of Merenptah. (See Pl. 44)

The temple of Merenptah had storehouses like the Ramessesum, but in this case they seem to have been roofed with wood, since no debris of collapsed vaults was found.⁵⁰ Vaulting was employed, however, over the entrance corridor to the stores, the roof consisting of three parallel vaults supported by two rows of columns.⁵¹ The architraves were made with their height greater than the width, so as to appear square when the upper part was hidden by the springing of the vault, which rested on a ledge in the stone. The inner diameter of this vault was 1.73m.⁵²

III. The Palace of Ay.

Between the third and fourth pylons of his funerary temple, Ay built a small square palace of white-plastered brickwork.⁵³ There were eight pillars in the broad hall across the front of the building, standing on brick foundations 90cm square. Many of the bricks in the structure were stamped with the name of Ay, or of the temple, and their dimensions were 40-42 x 19-20 x 12-13cm.⁵⁴

IV. Medinet Habu.

The Palace of Ramesses III.

The First Palace at Medinet Habu⁵⁵ was built of bricks 40 x 20 x 12cm in size, and had stone door-frames and columns, the latter resting on brick foundations, 1.50m square. Over the central hall were five narrow vaults, resting on stone architraves let into the South wall of the temple, and two other vaulted roofs covered the side-rooms. On

44. *ibid.*, 81-2.

45. Hölscher 34 x 17 x 5cm in *ibid.*, 81. But see also *L.D.*, I, 89.

46. Hölscher, U., *E.M.H.*, III, 82 & Pl. 40 D.

47. Fairman, H.W., *JEA* 25 (1939), 141.

48. Choisy, A., *L'Art de Bâtir chez les Egyptiens*, 19.

49. Hölcher, U., *E.M.H.*, III, 82.

50. Petrie, W.M.F., *Six Temples at Thebes*, 13.

51. Petrie, W.M.F., *op. cit.*, 12 & Pl. XXV.

52. *ibid.*, 12.

53. Hölscher, U., *E.M.H.*, II, 81-2.

54. *ibid.*, 80-1 & fig. 70.

55. Hölscher, U., *E.M.H.*, III, 44-6 & Pls. 27-30.

the revision of the design and the construction of the Second Palace, this roofing was altered to produce three vaults over the central hall and two lower vaults on either side.⁵⁶ Temporary centring of wooden beams was employed during the construction of the larger vaults, and the holes where the beams were set into the temple wall are still visible.⁵⁷ Similar holes in a wall of the East Gate had been patched with stone, showing that the beams were removed after completion of the roof.⁵⁸ The same technique was used in the temple of Beit el-Wali, where the marks of temporary centring can be seen at the rear of the vaulted entrance hall.⁵⁹

The doorways of the Second Palace were faced with stone or wood, the latter material possibly being fixed to the walls by wooden beams.⁶⁰ Some of the stone lintels were fastened to the brickwork by cords passed through holes in the stone (Fig.48), and the small rooms of the harim had lintels with sloping rear faces and arched projections to receive barrel vaults.⁶¹ In both the First and Second Palaces, the floors were composed of square slabs of mud-brick, 43 x 43 x 6cm in size, laid on sand and covered over with whitened plaster.⁶² The bricks of the Second Palace measured 37 x 18 x 11cm, and were laid in A2 and A3 bonding, the latter being more common.⁶³ Over the wall surfaces was a coat of plaster, which was painted in some rooms, whilst in the bathroom the walls had been faced with stone to protect the brickwork from the wet.⁶⁴

Administrative Buildings in the Temple Area.

Between the temple and the Inner Enclosure Wall were a number of buildings of official character.⁶⁵ Most of these structures had vaulted roofs, although a few wide rooms must have been roofed with wood. The storerooms are similar to those at the Ramesseum, comprising long vaulted tunnels 3.20m wide, built of bricks 40 x 20 x 14cm in size.⁶⁶ Storeroom K had a forecourt paved with brick slabs, 43cm square.⁶⁷

To the West of the Palace was a garden, in which several levels of construction were found, all within the reign of Ramesses III.⁶⁸ Square bricks, 43 x 43cm, were used for the floors, whilst those of the walls measured 40 x 20 x 12cm. In the higher levels of construction, brick sizes of 42 x 20 x 13cm and 38 x 18 x 11cm occurred.

Fig.48 Lintel held by cord,
Medinet Habu.



In the outer temple area stood a structure which the excavators called the "South Administration Building", built of mud-bricks 37 x 18 x 11cm in size, and covered by vaulted roofs.⁶⁹ The same brick size occurs in the Royal Stables, except in the courtyard, where the dimensions are 43 x 21 x 12cm.⁷⁰ No trace of columns could be detected in the latter building, and Hölscher came to the conclusion that the roof must have been vaulted, in which case it would be the largest vault known from Ancient Egypt, with a span of 8.60m.⁷¹

V. Malqata.

The Palace of Amenhotep III at Malqata covers an area of 100 x 200m and is built of bricks which are most commonly 33 x 16 x 10cm in size, although dimensions of 28 x 14.5 x 9cm to 39 x 18.5 x 12cm also occur.⁷² Mud-mortar was used to fill the joints in the brickwork, and the faces of the walls had been coated with plaster, on which decorative scenes had been painted. A few brick columns were found, some of which were hexagonal in shape,⁷³ but in the vast majority of rooms the columns were of wood, standing on stone bases.⁷⁴ In the small rooms and passages the roofing was composed of palm-fibre matting, coated with mud and supported by wooden beams, but in the larger rooms a more elaborate system was employed. This consisted of fastening a ceiling of light beams to the underside of the main rafters, and filling the spaces between the woodwork with mud. Beneath the ceiling beams were fibre mats, coated with decorated plaster.⁷⁵ (Fig.49).

56. *ibid.*, 38-9.

57. *ibid.*, 39 & Pl. 26.

58. Hölscher, U., *E.M.H.*, IV, 29.

59. Rieke, H. Hughes, G.R., & Wente, E.F., *Beit el-Wali*, I, 2 & Pl. 18.

60. Hölscher, U., *E.M.H.*, IV, 30.

61. *ibid.*, 30.

62. *ibid.*, 29.

63. *ibid.*, III, Pls. 27-29.

64. *ibid.*, III, 54.

65. *ibid.*, III, 62.

66. *ibid.*, III, 64-5.

67. *ibid.*, III, 65.

68. *ibid.*, III, 67.

69. *ibid.*, IV, 16.

70. *ibid.*, 18.

71. *ibid.*, 18.

72. Hayes, W.C., *JNES* 10 (1951), 164.

73. Tytus, R. de P., *Palace of Amenhotep III*, 14.

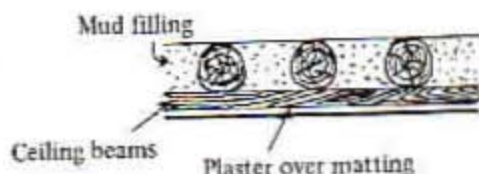
74. *ibid.*, 13.

75. Tytus, R. de P., *op. cit.*, 13.

Most of the floors were formed of plaster, which had been painted in some cases, although a few rooms had floors of brick.⁷⁶ Stone was used for the doorsills and wood for the lintels, but the doorjambs were usually formed in the brickwork.⁷⁷

A number of the bricks from the palace bore stamps of Amenhotep III and Queen Tiye, which are drawn in Plates 27-28.

Fig.49 Roofing in the Palace of Amenhotep III, Malqata.



SUMMARY: NEW KINGDOM OFFICIAL BUILDINGS

Location	Bonds	Brick Sizes(cm)	Notes
<i>Qalzum:</i> ⁷⁸ Barracks	A1 Irreg.	—	Brick-built soldiers quarters.
<i>Memphis:</i> Merenptah palace	—	39 x 19 x 8	Brick paving.
<i>Hermopolis:</i> Seti II palace	A1 A2 A3	40 x 40 x (?)	Square paving-bricks. Possibly vault-roofed.
<i>Amarna:</i> Water Court	—	—	Brick pillars reinforced with wood.
Temple Stores	—	—	Columns of special bricks.
Military Quarters	—	—	Circular and square piers of brick. Floors of mud or brick.
Police Barracks	—	35 x 38.5	Paving-slabs.
Desert Altars	Class A	—	Sand-filling in ramps and under paving. Stone casing on South Altar.
<i>Abydos:</i> Stores at Seti temple:			
walls	A2 or A3	40 x 20 x 14.5	Plaster on walls.
vaulting	d1	60 x 22 x 7.5	Bricks trimmed on underside, and plastered.
floors	—	44 x 44 x 16	Mud-brick paving slabs.
<i>El-Ballas:</i> South Palace ⁷⁹	—	—	East end of palace built on sand-filled foundation.
<i>Thebes:</i> Ramesseum palace	A2 A3	42 x 20 x 10	Mud-mortar. Plaster on walls & vaults 10cm thick.
stores	A2 A3	40 x 20 x 12-4	
	C1 d1	39-40 x 17-8 x 10	
	Irreg.	38-39 x 18 x 12-13	
		40 x 40	Paving slabs.
		35 x 21 x 6-7	Thin vault bricks.

76. *Ibid.*, 12.

77. *Ibid.*, 14.

78. Leclant, J., *Orientalia* 33 (1964), 342 & Pl. XXV, 4.

79. Badawy, A., *A History of Egyptian Architecture*, III, 47.

Location	Bonds	Brick Sizes(cm)	Notes
Merenptah temple stores	—	—	Wood-roofed stores, vaulted entrance corridor.
Palace of Ay	—	40–42 x 19–20 x 12–13	White-plaster on all brickwork.
Medinet Habu:			
Palace of Ramesses II	A2 A3	40 x 20 x 12 37 x 18 x 11	First Palace bricks. Second Palace. Stone door-frames. Vaulted roofing. Mud-brick paving slabs.
Storerooms	—	43 x 43 x 6 40 x 20 x 14	Paving slabs.
Garden	—	43 x 43 x 6 40 x 20 x 12 42 x 20 x 13 38 x 18 x 11 43 x 43 x 6	Paving slabs.
South admin. Building	—	37 x 18 x 11	
Stables	—	37 x 18 x 11 43 x 21 x 12	
Malqata:			
Palace of Amenhotep III		33 x 16 x 10 28 x 14.5 x 9 to 39 x 18.5 x 12	Wooden roofing. Much coloured plaster. Few brick columns.
Amarna West:			
Storehouses	d1	—	Vaulted stores as at the Ramesseum.

4. Official Buildings of the Twenty-First to Thirtieth Dynasties.

Very few buildings of this class have been discovered from the Late Period; many of those which must have existed would have been built in the Delta, where conditions have not been suitable for their preservation. A palace of Apries has been excavated at Memphis,⁸⁰ with stone-lined walls of brick, and stone doorframes, floors and columns. Owing to additions and alterations to the building over a period of time, the brick sizes vary considerably, as shown by the list on page 92. The brick walls of the palace were standing to a height of 12m at the time of their excavation, but have been greatly destroyed since then.

To the South of the Sacred Lake at Karnak stands a building which was both a storehouse and the place in which the sacred geese of Amun were kept.⁸¹ This structure, which was restored by Psamouthes of the Twenty-Ninth Dynasty, is built of bricks measuring 34 x 17 x 10cm laid in A2 bonding with mud-mortar, although stone is employed for the doorsills and jambs.

5. Graeco-Roman Public Buildings.

Alexandria

A building has been excavated at Kom ed-Dikka which may have been a Roman theatre.⁸² The walls combine the use of burnt brick and stone, in order to produce decorative bands of red and white on their faces. For roofing, use was made of arches, domes and vaults, but the precise form of these has not yet been published. In the vaults, the bricks were 23 x 17 x 3.5cm in size, and those of the walls measured 25 x 15 x 3.5cm and 25 x 25 x 4cm.

80. Petrie, W.M.F., *The Palace of Apries*, 1-5 & Pls. I, X-XIII.

81. *PM* II, 222. Also Rieke, H., *ZAS* 73 (1937), 124-131.

82. Kubiak, W.B. & Makowiecka, I., *ASAE* 61 (1973), 106-24.

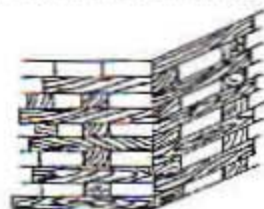
Medinet Maadi.

In the Italian excavations at this site, a large building of the first century A.D. has been discovered,⁸³ which may have had some public use, possibly as a storehouse. It is built of mud-bricks measuring 25 x 10 x 10cm, laid in A2 or A3 bonding, and has exterior walls constructed in alternate concave and level sections,⁸⁴ like the temple walls of Pharaonic Egypt. An interesting feature is the extensive use of wood in the building, large square-section beams being set transversely and longitudinally in the walls at regular intervals.⁸⁵ The transverse beams are separated by the width of three bricks and occur in the header courses, whilst the longitudinal beams are very long and replace most of the stretcher course. Also, the beams running along the face of the wall are set into a course adjacent to those in which the transverse beams occur, as shown in Fig 50. Timbering of the corners of the walls is very extensive, every other layer of bricks at the angle being replaced by wood, with more beams running through the wall only one brick-length from the corner.⁸⁶ (Fig.51) Wood is also employed for the door sills and for lintels above the windows, but not so common for roofing, for which purpose brick vaults seem to have been used in some rooms.⁸⁷ The timbering in this building is paralleled in the houses at other Graeco-Roman town sites, such as Karanis and Dime, and the reasons for this practice are discussed in Chapter 13.

Fig.50 Timbering of wall, Medinet Maadi.



Fig.51. Timbering of corners, Medinet Maadi.



Dime.

One large and well-constructed building at Dime was considered by the excavators to have been for some official purpose, since it differed considerably in style from the ordinary houses. This building, numbered II.201,⁸⁸ is constructed of mud-brick 29-30 x 14-15 x 11cm in size, laid in A3 bonding and in concave courses.⁸⁹ The angles of the brickwork were protected by wooden posts set vertically, fixed in place by beams on either side, whilst further timber reinforcement was used in the walls⁹⁰ (Fig.52). One of the interior rooms had been entirely lined with wood up to the height of the top of the door, this panelling being formed of thick beams laid along the wall faces, mortised to blocks of wood set more deeply into the wall⁹¹ (Fig.53). Wood was also employed for the doorframes, which were

Fig.52 Timber in wall, House II.201, Dime.

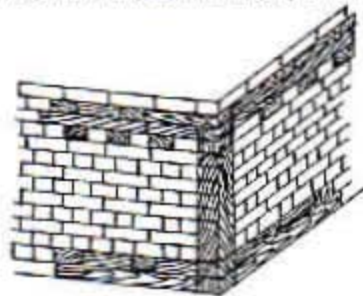
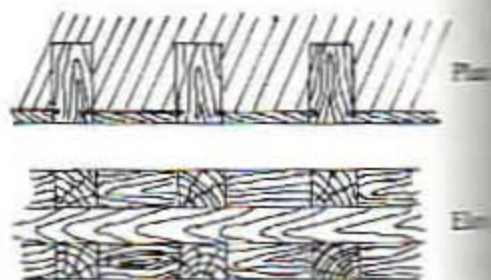


Fig.53 Wood Panelling, House II.201, Dime.



fixed into the wall by thick beams built into the brickwork. The roofing of the underground rooms was accomplished by the use of brick vaults of d1 or x1 form, built of thin bricks, 32 x 25 x 6cm in size.⁹² Lighting and ventilation in these cellars were provided by narrow windows situated near the ceiling, and by vents in the crown of the vaults.⁹³

83. Bresciani, E., *Medinet Maadi*, 1966-7, *passim*.
84. *ibid.*, 43 & Pl. XLV, 1.
85. *ibid.*, 43-4 & Pls. XXVII, XLV-XLVII.
86. *ibid.*, 44 & Pls. XXX-XXXI and Colourplate A.
87. *ibid.*, 45 & Pls. XIV, XXXVIII, 5, XLII.
88. Bosk, A.E.R., *Soknopaiou Nesos*, 19-3 & Plans III-V.

89. *ibid.*, 11 & Pl. V (Fig.8) & Plan XII.
90. *ibid.*, 11 & Plan XVI.
91. *ibid.*, 11-2 & Pls. VI-VII & Plan XV.
92. *ibid.*, 12 & Plan XVI.
93. *ibid.*, 12 & Plans XV-XVI.

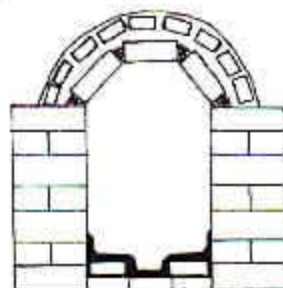
Dendera.

The early Ptolemaic sanatorium⁹⁴ at Dendera is built of mudbrick, but with the walls around the baths protected by a casing of burnt brick. Most of the brickwork is bonded A1, but a few courses of C1 occur. The baths themselves are formed of burnt bricks, 27 x 13 x 8cm and 30 x 15 x 6cm in size, overlaid with a waterproof lime plaster.⁹⁵

Thebes.

A number of brick water-conduits were laid out in the Roman period within the enclosure of the temple of Medinet Habu.⁹⁶ The first of these consisted of a 55cm wide channel enclosed by side-walls of burnt brick built in C1 bonding, with a vaulted cover of type bd1 over the top⁹⁷ (Fig.54). The bricks measure 31 x 14.5 x 6.5cm, and the joints had been filled with lime mortar, which was also used to line the channel. (See Pl.54A.)

Fig.54 Conduit A at Medinet Habu.



Another nearby conduit⁹⁸ was of similar construction, with the same type of bonding used in the walls and the roof, except that the inner ring of the vault had only two bricks in place of three (Fig.55). Some later conduits were of different form, consisting of clay pipes encased in burnt brick,⁹⁹ as shown in Fig.56. The well from which these channels were fed was walled round with burnt bricks 31 x 14.5 x 6cm in size, laid in C1 bonding.¹⁰⁰ (See Pl.54A.)

Conduits of Roman date which have been found at other sites¹⁰¹ in Egypt conform very closely to the construction of these examples at Medinet Habu, and individual description is therefore not given here.

Fig.55 Conduit B at Medinet Habu.

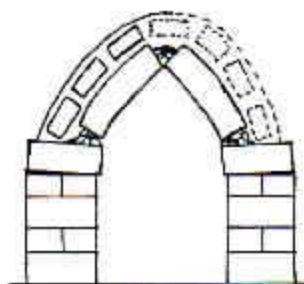
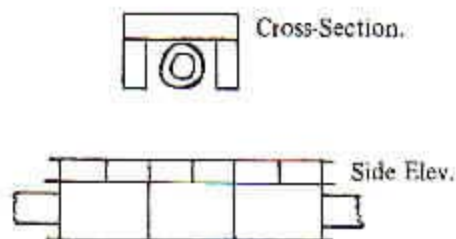


Fig.56 Later conduits at Medinet Habu.



Edfu.

In the Graeco-Roman town of Edfu, a number of Roman baths have been discovered,¹⁰² the structural characteristics of which are similar to other baths of the same age in Egypt. In order to provide resistance to the wet, burnt bricks are used in the construction, mortared with white or pink impermeable plaster.¹⁰³ This type of mortar is also employed for rendering the walls and for covering the floor. The bonding of the brickwork in the baths at Edfu is a mixture of A1 and C1,¹⁰⁴ the latter becoming more common in Roman times than previously. In one of the buildings, the burnt bricks were 30-1 x 15 x 8.5-9cm in size, whilst in another bath further to the south they measured 28 x 13 x 6.5cm.¹⁰⁵

94. Daumas, E., *BIFAO* 56 (1957), 35-57 & Pls. I-XIV.

95. *ibid.*, 38 & Pls. VIII B, IX-XII.

96. Hölscher, U., *F.M.H.*, V, 40-2.

97. *ibid.*, 40.

98. *ibid.*, 40-1.

99. *ibid.*, 40-2.

100. *ibid.*, 40.

101. For example: at Tod. See Bisson de la Roque, E., *Tod*, 30-1.

102. Michalowski, K., *Tell Edfu*, I (1937), 65-82.

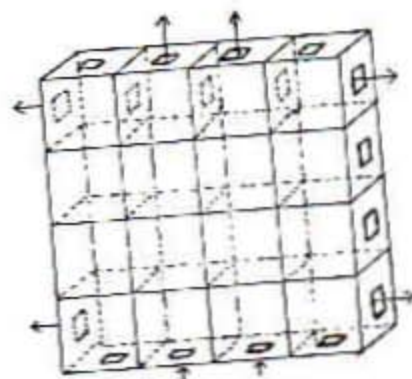
103. *ibid.*, 65-8, 80.

104. *ibid.*, 64 (fig. 28), 78-9 (figs. 34-5), 80.

105. *ibid.*, 65, 72, 80.

Many other baths of the same period have been found at sites in Egypt,¹⁰⁶ but their structural features are so uniform that the details of the Edfu baths, given above, may be taken as typical of this type of building. The use of burnt brick is the general rule in all baths, and it is also employed for the conduits which provided the water supply. Waterproof lime-plaster was also essential for the lining of the walls and floors. Some special bricks used in the walls of certain baths should be noted: these are hollow bricks through which the heating air was driven, so as to conduct the warmth to the separate rooms¹⁰⁷ (Fig.57).

Fig.57 Hollow bricks used in Roman Baths.



SUMMARY: OFFICIAL BUILDINGS OF THE XXIst-XXXth DYNASTIES AND OF THE GRAECO-ROMAN PERIOD

Location	Bonds	Brick Sizes(cm)	Notes
Memphis: Palace of Apries	-	29-30.5 x 14-15 x 10-12 33 x 18.5 x 12.5 34 x 17 x 13 43-46 x 21-23 x 11.5-15 37.5 38 x 18-20 x 12-13.5 39.5 x 20 x 12.5 41-42 x 19-20 x 12-13 43 x 20.5 x 14 45.5 x 20.5 x 14	All black mud bricks. Some walls stone-lined.
Karnak: Building of Psamouthes	A2	34 x 17 x 10	Stone door-frames in brick walls.
Alexandria: Roman theatre		25 x 15 x 3.5 25 x 25 x 4 23 x 17 x 3.5	Burnt brick construction. Vault bricks.
Medinet Maadi: Building I	A2 A3	25 x 10 x 10	Outer walls in concave beds, reinforced with wood. Some vaulted roofs.
Dime: House II.201	A3	29-30 x 14-15 x 11 32 x 25 x 6 (vaults)	Concave-laid brickwork, with timber reinforcement. Wooden panelling, doorways & windows. Vaulted cellars.
Dendera: Sanatorium	A1 C1	27 x 13 x 8 30 x 15 x 6	Burnt bricks with lime plaster.

106. See Khasab, A.M., *Ptolemies & Roman Baths of Kom el-Ahmar*, 57.
107. Khasab, A.M., *op. cit.*, 18-9.

Location	Bonds used	Brick sizes (cm)	Notes
<i>Thebes</i> (Medinet Habu) Conduits	C1 d1	31 x 14.5 x 6.5	Burnt brick construction with waterproof plaster. Vault bricks have grooved faces.
<i>Edfu</i> Roman baths	A1 C1	30-31 x 15 x 8.5 9 28 x 13 x 6.5	Pink waterproof plaster over burnt bricks. Some mud-brick used, but not in areas subject to damp.

CHAPTER SEVEN: DOMESTIC ARCHITECTURE

1. Periods up to Dynasty XII.

The earliest brick-built houses so far known in Egypt are those of the South Town at Naqada, which have been mentioned already, in Chapter Two. Other Predynastic sites have yielded remains of wattle and daub houses, but the use of brick seems to have been almost non-existent. This lack of examples continues into the Archaic Period, although settlements of Third Dynasty or early Old Kingdom date have been found at Hierakonpolis¹ and El-Kab.² At the former site, the houses were built of bricks 25.5–26 x 10.5–13 x 6–7 cm in size; such small dimensions would suggest that they belong to the Third rather than the Fourth Dynasty. No information about the structure of the buildings at El-Kab is, as yet, available.

Numerous examples of houses of the Old Kingdom have been discovered, but hardly any technical details are recorded. This is true of the town which lay to the south of the tomb of Queen Khentkawes at Giza;³ the brickwork here could have provided useful information, but no record was made, and the walls are now so denuded that they are mere lines of black dust on the rock surface. Some facts can be stated about the houses of the Sixth Dynasty which overlay the Valley Temple of Mycerinus.⁴ These were built of mud-brick, bonded A1 or X1, with black mud-plaster on the wall surfaces. The roofing may have been vaulted, but, in view of the thinness of the walls, is more likely to have been of wood. In some of the houses stone thresholds and lintels were employed.

At Abusir were several priests' houses in the area of the mortuary temple of Neferirkare, along the south side.⁵ These dwellings had thin walls in A1 and A2 bonding, and must have been roofed with wood. Further south, at Saqqara, a group of domestic buildings stood around the pyramid of Queen Wedjeten, between the pyramid and its enclosing wall, and these may also have formed the houses of the priests.⁶

2. Middle Kingdom Houses.

For the Middle Kingdom there is again not a great deal of information concerning the structural aspects of domestic architecture. The surviving remains include some priests' houses to the South of the causeway of the pyramid of Amenemhat III at Dashur,⁷ and the pyramid-town of Sesostris II at El-Lahun.⁸ Of the former buildings no details are known, but some facts can be stated about the houses of Lahun. Both the large mansions and the small houses at this site usually had flat roofs, formed of wood, reeds and mud, but a few vaulted rooms were found.⁹ Arches were commonly used over the doorways, formed of bricks on edge (type c1) and two courses in thickness, with limestone flakes in the gaps between the bricks. Petrie suggested¹⁰ that these arches would probably have been constructed on a sand centring, which is very likely to be correct.

3. New Kingdom Houses.

Amaria.

This is without any doubt the best site for the study of domestic brickwork in the New Kingdom, but the structural details are not so complete as they should be, for the reason given on p.64. In the Main City, the large mansions had plastered walls and flat roofs, the dividing walls of the rooms being unbonded with the outer walls of the house. The floors usually consisted of a layer of ordinary bricks, or of stamped mud, but in the house of Nakht square mud-brick tiles were employed.¹² In the large rooms there were wooden columns to support the roofing beams, resting upon bases of stone. Stairways were constructed on sloping beams and planks,¹³ except for the lowest steps, which were of solid brickwork (Fig.58). The use of timber to strengthen the walls of houses seems to have been rare at this period, only

1. Quibell, J.E. & Green, F.W. *Hierakonpolis*, II, 16–9, 23.
2. Meulenare, H. de, *CdE* 45 (1970), 32–4.
3. Hassan, S., *Excavations at Giza*, IV, 35–42, 59–61 and Fig.1.
4. Reisner, G.A., *Mycerinus*, 49–54 & Pls. 31–5.
5. Borchardt, L., *Das Grabdenkmal des Königs Neferirkare*, 36–7 and Pl.10.
6. Jéquier, G., *La Pyramide d'Oudjefhen*, 25 & Pl.I.
7. De Morgan, *Fouilles à Dachour*, 1894–5, 102.

8. Petrie, W.M.F., *Kahun, Gurob & Hawara*, 21–32.
Also *Illahun, Kahun & Gurob*, 5–8 & Pl.XIV.
9. Petrie, W.M.F., *Kahun, Gurob & Hawara*, 23.
10. *Ibid.*, 23.
11. Petrie, T.E. & Woolley, L., *City of Akhetaten*, 1, 5–50 & Pls. 1–10.
Also Riecke, H., *Der Grundriss des Amarna Wohnhauses*, 1900.
12. Petrie & Woolley, *op. cit.*, 38.
13. Petrie, T.E. & Woolley, L., *op. cit.*, 23–4.

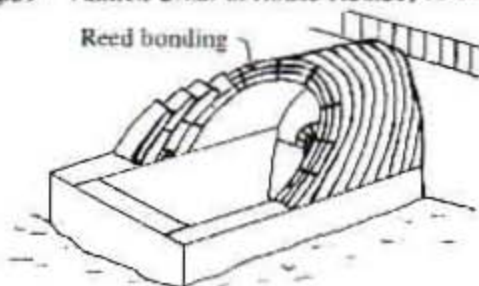
one example having been reported from Amarna of a house with beams set regularly into the brickwork.¹⁴ Fairly thin walls were built around the estates, the average being a thickness of two brick-lengths. In cases where the walls were only a single brick in thickness, they were supported by buttresses at intervals.¹⁵

The estates in the North Suburb¹⁶ had columns and roofs of wood, similar to the houses of the Main City, and were built of bricks measuring 33-6 x 15-16 x 9cm.¹⁷ Some houses, such as T.36.59, had cellars with arched doorways and vaulted roofing.¹⁸ The construction of this type of cellar is shown in Fig.59, where it can be seen that the vault is of d1 form and the door arch is of type c1. An unusual feature is the insertion of two reeds between the rings of bricks in the vault, to provide a key for the mortar. A cellar in U.33.3 was roofed in a different way, by corbelling the brickwork.¹⁹

Fig. 58 Stairs built on wooden beams, Amarna.



Fig. 59 Vaulted Cellar in House T.36.59, Amarna.



The only bonds recorded from the houses come from V.36.7 and T.36.36,²⁰ where the walls were constructed in A2 bonding, with wide unmortared vertical joints in the middle of the brickwork. Around the estate V.37.1 was a wall of sinusoidal form, one brick in thickness, which would in all probability have been bonded X1.²¹

The East Village at Amarna²² was the site of the workmen's houses, laid out on regular lines. The enclosing walls of the village, and the main cross-walls, were built first, with bricks 33cm in length, and the brickwork of the houses does not interbond with them.²³ Most of the houses had brick thresholds, formed of headers or bricks on edge, but some had stone sills. Wood was used for the door-frames, the jambs being fastened to the brickwork by wooden pegs.²⁴ In the main room was a single wooden column, probably a simple post, to support the flat roof of wood and reeds.²⁵ The lower flight of the stairs was usually built over arches.²⁶ The interior walls of the houses were coated with plaster, which was decorated in some cases.

Abydos.

Amosis I established a town at Abydos,²⁷ near the site of his temples and cenotaph. The small part of this town which has been excavated²⁸ contains large mansions, and was evidently planned as a single unit, since the main walls are common to many houses.²⁹ No details of the structure of the buildings are given in the report, but the size of the rooms would suggest that the houses had flat roofs, supported by wooden rafters.

Thebes.

A village of considerable extent grew up during the reign of Amenhotep III, immediately West of his mortuary temple in Thebes.³⁰ The houses contained from four to seven rooms, and had thin, mud-plastered walls built in A1 and A2 bonding.³¹ Some of the courtyards were enclosed by sinusoidal walls, formed entirely of stretchers (X1 bond), whilst others had straight walls reinforced by buttresses at intervals.³² It is interesting to note that walls of the former type were discovered around small workers' dwellings near the temple of Hatshepsut at Deir el-Bahari.³³ In the village of Amenhotep III, some of the undulations in this type of wall had been masked on the inner face by short cross-walls,³⁴ as shown in Fig.60. The bricks of the houses varied in size, since some are of the small domestic format and others are the larger bricks produced for official buildings, the latter group in certain cases bearing the stamps of Amenhotep III. The inscriptions are included on Plate 26, and the dimensions of the bricks are given on page 97.

14. Borchardt, L., *MDGU* 46 (1911), 24-5.

15. Peet & Woolley, *op. cit.*, 47.

16. Frankfort, H. & Pendlebury, J.D.S., *City of Akhenaten*, II, 1-77.

17. *Ibid.*, 98.

18. *Ibid.*, 52-3.

19. *Ibid.*, 73.

20. *Ibid.*, 98.

21. Frankfort, H. & Pendlebury, J.D.S., *City of Akhenaten*, II, 5.

22. Peet, T.E. & Woolley, L., *City of Akhenaten*, I, 51-91.

23. *Ibid.*, 53. Pls. XVI-XVII.

24. *Ibid.*, 58-9.

25. *Ibid.*, 57-8.

26. *Ibid.*, 58.

27. Currelly, C.T., Aytton, E.R. & Weigall, A.E.P., *Abydos*, III, 37-8.

28. *Ibid.*, 37-8.

29. *Ibid.*, Pl. LIII.

30. Robichon, C. & Varille, A., *Amenhotep fils de Hapou*, 33-4, Pl. VIII and Holscher, U., *E.M.H.*, II, 68-71.

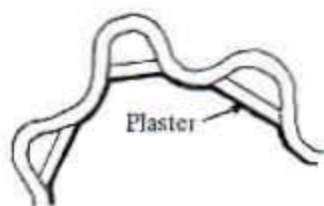
31. Robichon & Varille, *op. cit.*, Pl. VIII. Holscher, *op. cit.*, 70-1.

32. Holscher, *op. cit.*, 70.

33. Carter, H., *Five Years Exploration at Thebes*, 30 & Pl. XX.

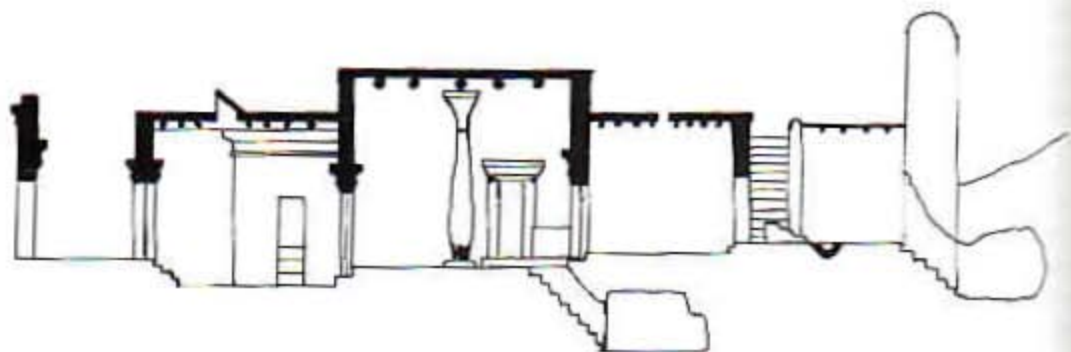
34. Holscher, *op. cit.*, 70-1.

Fig. 60 Wavy Wall, in village of Amenhotep III, Thebes.



Many more houses of the New Kingdom lie in the workers' village at Deir el-Medina,³⁵ enclosed originally by a brick wall, built by Tuthmosis I, and later by a Nineteenth Dynasty wall of rough stone construction. The houses have virtually no foundations, except when built on rubble, in which case they have a substructure of stone or brick. The walls of the earlier houses are formed entirely of brick, but in those of Ramesside times stone is used for the lower courses. Traces of holes in the top of the walls show where the roofing beams were inserted, the roofs being flat and not vaulted (Fig. 61). However, the stairs to the roof and to the cellars were often covered by brick vaults, and the edges of the roofs were reinforced with stone.³⁸ The bonds of the house walls are A1, A2 and A3, the last named being used in the thicker walls, and both white and coloured plaster occurs on the interior surfaces. In the houses of the Eighteenth Dynasty the bricks are of better quality than later, those of the Ramesside period containing a greater proportion of sand and gravel.³⁹ Many of the bricks bear stamps with the names of Pharaohs, but only those of Tuthmosis I, found in the enclosure wall of the village, are in their original location, the others having been re-used.⁴⁰ A large number of measurements of the bricks have been recorded, and these are given in the table on page 97.

Fig. 61 Section of House in Deir el-Medina Village.



A number of houses were constructed within the temple area at Medinet Habu as a part of the original layout of the complex, possibly serving as dwellings for the priests.⁴¹ On each side of the temple were two rows of houses, built of bricks 37 x 18 x 11 cm in size. The houses of the front row had large rooms, and were probably wood-roofed, while the smaller rooms in the houses at the rear may have been vaulted.

35. Bruyère, B., *Deir el-Medineh*, 1934-5, *passim*.

36. Bruyère, B., *Deir el-Medineh*, 1934-5, 28.

37. *Ibid.*, 28 and 50, fig. 15.

38. *Ibid.*, 29.

39. *Ibid.*, 21.

40. *Ibid.*, 24-7.

41. Hölscher, U., *E.M.H.*, IV, 14-5.

SUMMARY: BRICKWORK IN NEW KINGDOM HOUSES

Location	Bonds	Brick Sizes(cm)	Notes
<i>Hermopolis:</i> ⁴²	—	32–33 x 15–19 x 8–11 28–30 x 12–16 x 8–9	
<i>Amarna:</i> Main City	—	—	Plastered walls, wood roofs and brick floors. Stairs built on beams.
N. Suburb	some A2	33–36 x 15–16 x 9	Wooden roofing. Cellars with d1 vaults, entered by arched doors.
E. Village	—	33cm. long.	Wooden roofing. Stairs built over beams. Brick thresholds.
<i>Abydos:</i> Town of Amosis I	—	—	Large mansions, probably wood-roofed.
<i>Thebes:</i> Village of Amenhotep III	A1 A2 X1	30 x 15 x 8 30 x 16 x 8 30 x 14 x 9 31 x 15–16 x 9–10 32 x 15 x 9–10 33 x 15–16 x 8.5–10 34 x 16 x 9 36 x 17 x 9 37 x 19 x 11 41 x 19 x 11	Houses of 4–7 rooms. Thin plastered walls, some built on 'wavy' plan. Some bricks bear name of Amenhotep III.
Deir el-Medina	A1 A2 A3	33 x 17 x 11 40 x 18 x 11 36 x 16 x 11 35 x 16 x 11.5 30 x 16 x 10 33 x 16 x 12 35 x 15 x 11 34 x 17 x 12 34 x 16 x 10 40 x 20 x 12 35 x 17 x 10 32 x 16 x 10 33 x 16 x 10 37 x 16 x 10 37 x 16 x 12 40 x 17 x 10 30 x 15 x 9 30 x 16 x 9 30 x 15 x 10 30 x 15 x 7.5 31 x 15 x 9 33 x 15 x 9 37 x 18 x 11	Stamp: Tutmosis I. Wooden roofing. Vaults over stairs. Only one vaulted room found in entire village. ⁴³ XVIIIth Dyn. bricks superior to later examples. Some special bricks for vaults and cornices.
Medinet Habu	—	—	
<i>Sesebi:</i> N.K. Town ⁴⁴	—	—	Plastered walls, mud floors and flat roofs. Stone door-sills.
<i>Amara West:</i> N.K. Town ⁴⁵	—	—	Many vaulted roofs and arched doorways.

42. Roeder, G., *Hermopolis*, 1929-39, 10.

43. Bruyère, B., *Deir el-Medineh*, 1934-5, 263.

44. Blackman, A.M., *JEA* 23 (1937), 150 & PL. XI X

45. Fairman, H.W., *JEA* 34 (1948), 3-11.

4. Houses of the Twenty-First to Thirtieth Dynasties.

Saqqara.

A large house, of Thirtieth Dynasty date, has recently been discovered at Saqqara,⁴⁶ built against the side of one of the brick foundation-platforms discussed above (page 72). The walls of the house are constructed of brick 38.5—40 x 19 x 12—13 cm in size, mortared with *tafl*, and coated with whitened plaster. At the doorways of two of the internal rooms, a log of wood is set across the threshold, to resist wear on the step. The different forms of bonding used in the walls are A1, A2 and A12, and the liaison of the brickwork at the South West corner of the building is improved by a wooden tie set in the wall.

Lisht.

A village grew up in the Twentieth to Twenty-Second Dynasties beside the pyramid of Amenemhat I at Lisht, made up of poor, two-storey houses.⁴⁷ The majority of the walls were built in A1 or X1 bonding, with many bricks laid on edge to compensate for changes in level.

Hermopolis.

The Late-Period houses of Hermopolis were constructed of mud brick, assembled in A2, A3 and A4 bonding.⁴⁸ In the older levels of the Late-Period strata, the bricks measured 33 x 15 x 7—8 cm, but at a slightly higher level they were 40 x 17—18 x 7—9 cm in size. Finally, at a date immediately prior to the beginning of Ptolemaic rule, bricks at 36 x 14—15 x 6—7 cm occur.⁴⁹

Thebes.

Within the enclosure of the temple of Ramesses III at Medinet Habu, a town developed, containing houses from the Twentieth Dynasty onwards.⁵⁰ A number of dwellings of the Twenty-First Dynasty were found to be well-preserved in the North-East part of the temenos, constructed of bricks measuring 36—38 x 18 x 9—11 cm, and, in some cases, having re-used door-frames of stone.⁵¹ One house had a floor of burnt brick,⁵² but usually mud-bricks were used for this purpose. In the house of Butehamun, on the West of the temple, the bricks measured 37 x 18 x 10 cm and the roof was supported on stone columns.⁵³

The houses of the Twenty-Second Dynasty have small rooms, divided by thin walls of careless construction. One example of a burnt brick floor was discovered, in house IV,⁵⁴ whilst two other houses had floors of square mud-bricks, 40 x 40 x 7 cm in size.⁵⁵

By the Twenty-Fifth to Twenty-Sixth Dynasties the whole temple-area was crowded with houses, built of sandy mud-bricks measuring 29 x 14 x 8 cm to 30 x 15 x 9 cm.⁵⁶ A large house to the South of the temple had stairways to the cellars and to the upper floors, each step being supported by a beam 8 cm in diameter.⁵⁷

5. Graeco-Roman Houses.

Qasr Qarun.

Some domestic buildings at this site have a certain amount of timbering in the brickwork,⁵⁸ of the same type as occurs at Karanis and Dime (see below, page 99). Wood is also employed above and below the windows and cupboard niches, as well as for reinforcing the stair treads. Some of the beams which were set in the face of the walls have been removed for the sake of the wood, but the long channels in the brickwork show clearly their original position.⁵⁹

46. See n. 193, p. 72 above.

47. Mace, A.C., *BMJA* XVI (Nov. 1921), II, 3, 12-3.

48. Roeder, G., *Hermopolis*, 1929-39, 9-10 & Pl. 12 (i).

49. *Ibid.*, 11.

50. Hölscher, U., *EMH*, V, 4-16.

51. *Ibid.*, 5.

52. *Ibid.*, 5.

53. *Ibid.*, 4-5.

54. *Ibid.*, 8.

55. *Ibid.*, 7.

56. *Ibid.*, 14-5.

57. *Ibid.*, 16.

58. Schwartz, J. & Wild, H., *Qasr Qarun/Djunayz*, I, 19 & Pls. VIII-3.

59. *Ibid.*, Pls. VIII-X.

Philadelphia and Theadelphia.

The houses of Philadelphia have their smaller rooms roofed with split palm-logs and larger rooms covered by vaults.⁶⁰ At Theadelphia, the former method was employed, with layers of bricks placed over the logs.⁶¹ All the construction of these dwellings consisted of mud-brick, including the stairways, which had to be protected from wear by thin strips of wood at the front edge of the steps.

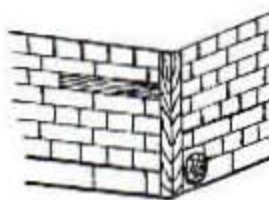
Karanis.

The site of the Græco-Roman town of Karanis contains houses ranging from the late Ptolemaic period to the Fifth Century A.D.,⁶² built almost entirely of mud-bricks measuring 26-27 x 12-13.5 x 7.5-11 cm.⁶³ Use of burnt brick was scarce, even in the latest strata. The usual bonding is A3 in the main walls, and A1 or A2 in the thinner partitions, whilst in the houses of the Fourth and Fifth Centuries A.D. some C1 bonding is found.⁶⁴ Great amounts of wood were employed in the construction of the houses, for door-frames, windows, roofing and for reinforcing the brick walls.⁶⁵ The latter use was carried to extremes, and huge baulks of timber were built into the brickwork, especially at the angles, where upright beams were fixed in order to prevent damage to the corner.⁶⁶ These beams were held in place by their being mortised to other blocks of wood, which were set deeply into the brickwork, as shown in Fig. 62. In house B.1, the lower end of the corner post was attached to the trunk of a tree which had been built into the wall near the ground level.⁶⁷ (Fig. 63). Other buildings had their corners protected by separate pieces of wood laid in the place of bricks, instead of an upright post, and in one or two examples the reinforcement was formed of stone blocks.⁶⁸

Fig. 62 Corner Timbering at Karanis.



Fig. 63 Corner of House B.1 at Karanis.



Long beams were also set into the main walls of the houses, laid both transversely and longitudinally in the brickwork, being visible on the outer faces.⁶⁹ Usually the transverse timbers were jointed to those laid along the face of the wall, so as to hold the latter in position. Beams laid lengthways occur above and below the windows, and are frequently long enough to run the full length of the wall and function for two windows at the same level.⁷⁰ A number of houses have their exterior walls built in concave courses of brickwork,⁷¹ but where long timbers are used around the windows the bricks on the inner face of the walls are, out of necessity, laid flat.⁷²

The doorways are framed entirely with wood, the lintel, sill and jambs all being jointed together by tenons, and the whole fixed in position by blocks of wood set in the surrounding brickwork. Logs, covered over with reeds and mud, were employed for roofing,⁷³ except in the cellars, which were covered by vaults of d1 or x1 form.⁷⁴ These vaults were composed of thin mud-bricks, some of which were of square shape.⁷⁵ White plaster was used for pointing the horizontal joints in the brickwork, but for rendering the walls a thin coat of grey or brown plaster had been employed.⁷⁶

60. Zuckert, F., *Archäologischer Anzeiger*, 1909, 179-86.

61. Grenfell, B.P. & Hunt, A.S., *Fayum Towns & their Papyri*, 51.

62. Bouček, A.E.R., *Karanis 1924-8*, 4-5.

63. *ibid.*, 8, 57, 64.

64. *ibid.*, 8 & Pls. III, IV, XVII, XXV & XXX.

65. *ibid.*, 28.

66. *ibid.*, 13, 25-6 & Pls. VII, 14 & XVIII, 36.

67. *ibid.*, 13 & Pl. VII, 14. 68. *ibid.*, 26 & Pl. XLII, 84.

69. Bouček, A.E.R., *op. cit.*, 28 & Pls. XXXI, XXXVI (72).

70. *ibid.*, 49 & Pls. XXXI (61), XXXII (63), XXXIV (67).

71. *ibid.*, 13, 46 & Pl. XVII (33), XXXIV (67), XXXVI (72).

72. *ibid.*, 49.

73. *ibid.*, 26 & Pls. XIX, XLI (81).

74. *ibid.*, 23-4, 66-7 & Plans IIIA-B, Pls. XII (24), XIV, XVIII (35).

75. *ibid.*, 23.

76. *ibid.*, 29.

Dime.

The houses of Dime are similar to those of Karanis, and date from the late Ptolemaic age to the Third Century A.D. They are built of small mud-bricks, laid in A2 or A3 bonding, and frequently exhibit concave courses in the exterior walls.⁷⁸ Wood was employed to a lesser extent than at Karanis, but it is still found in fair quantity around the doorways and cupboard-niches. The door-jambs of house I.112 had beams of timber set into the brickwork,⁷⁹ as shown in Fig. 64.

Many houses had cellars roofed with d1 or x1 vaults, and small arches were employed over the doorways and niches. The roof of the cellar in house I.108 was of unusual form, consisting of a d1 vault, the courses of which were inclined in two directions in a single layer of brickwork.⁸¹ (Fig. 65). In addition, the vault had been made slightly higher in the middle than at the edges, giving it a domed appearance.⁸²

Fig. 64 Doorway of House I.112, Dime.

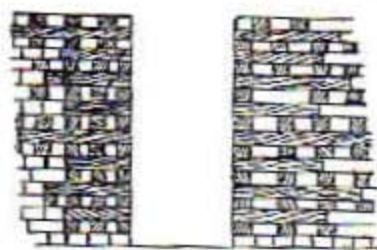
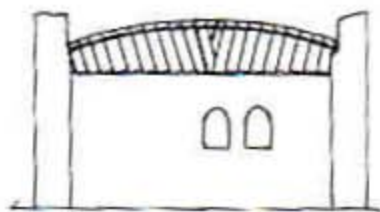


Fig. 65 Section of Vault, House I.108 at Dime.



Hermopolis.

In the houses of Graeco Roman age at this site, the bricks are unbaked and measure 33 x 15-18 x 7-11 cm and 30 x 12 x 8 cm.⁸³ Burnt bricks begin to be used in the later Roman levels, and are employed extensively in the Coptic houses, where their dimensions are 22-24 x 10-12 x 6-7 cm.⁸⁴ The bonding of the Coptic brickwork is usually type A1 or C1.⁸⁵

Medamud.

A number of houses of Romano-Coptic date have been excavated at this site,⁸⁶ built mainly of mud-bricks, but with burnt brick used in all places subject to wear or damp, such as floors, drains and baths. The columns of one house were formed of circular burnt bricks, which varied in diameter from 18.5 to 21 cm.⁸⁷

Medinet Habu.

A group of houses of Roman age lay just outside the East enclosure wall of the temple of Medinet Habu, built of mud-bricks in A2, A3 and A18 bonding, together with a small amount of type C6.⁸⁸ The houses were probably roofed with wood, although some of the ground-floor rooms and bathrooms were vaulted. Two bathrooms were found,⁸⁹ one built almost entirely of burnt brick, and the other only lined with that material. Ducts for heating ran beneath the floors and through the walls, some of the latter being faced with hollow bricks measuring 48 x 30 x 7.5 cm, covered over with lime plaster.⁹⁰ The mud-bricks of the house walls were of less size, being 31-32 cm in length.

Medinet Habu continued to be a populated area through the Coptic period, the houses of the town of Jeme being constructed in the old temenos, above the enclosure wall, and inside the temple itself.⁹¹ These Coptic houses were built of mud-bricks measuring 30 x 14 x 6 cm to 31 x 15 x 7 cm, with a few burnt bricks used for foundations, doorsills and jambs, water-jug niches, and less frequently for floors and the springing of vaults.⁹² In a few cases, such as house 45, there were decorative patterns of burnt brick set into the mud-brick walls.⁹³

77. Bosk, A. E. R., *Soknopaiou Nesos*, 18-9.

78. *ibid.*, 17 & Pls. VIII-IX, XII.

79. *ibid.*, Pl. VIII (14).

80. *ibid.*, 15 & Pls. X & Plan XII-XIV.

81. *ibid.*, Pl. X (19).

82. *ibid.*, 15 & Pls. X & Plan XIV.

83. Roeder, G., *Hermopolis*, 1929-39, 11.

84. Roeder, G., *Hermopolis*, 1929-39, 11.

85. *ibid.*, 10 & Pl. 20.

86. Bisson de la Roque, F., *Medamoud*, 1927, 25ff., 1928, 18-26, 1929, 15-36.

87. *ibid.*, 1927, 31.

88. Hölscher, U., *E. A. H.*, V, Pls. 24-5.

89. *ibid.*, 38.

90. *ibid.*, 38 & Pl. 25c.

91. *ibid.*, 45-50 & Pls. 41-4.

92. Hölscher, U., *E. A. H.*, V, 45-6.

93. *ibid.*, 47.

The majority of the rooms were roofed by vaults, especially the cellars, which had ventilation holes in their roofs. Arches and vaults were also used over the doorways and beneath the stairs (Fig. 66 and Plates 55A–B). Most of the vaults over the rooms are of type x1 or d1, whilst the smaller arches of the doors, windows and niches are bonded c1, bc1 or bx1.⁹⁴ (Fig. 67). The walls are commonly built in C1 or C3 bonding, but a fair amount of A1, A2 and A3 also occurs (see Plates 55–56). Contrary to the usual practice in earlier Egyptian brickwork, the walls were not always mud-plastered on the exterior, and in house 45, in which decorated brickwork was found, no plaster was used on the interior surfaces also.⁹⁵

Fig. 66 Stairs over Arches, in houses at Jeme.



Fig. 67 Arched Cupboard-niche, House 45, Jeme.



Armant.

Just beyond the East temenos wall of the Baqaria at Armant was the site of a village of Roman age.⁹⁶ The remains were extremely destroyed, but sufficient had survived to show that A2 and C1 bonding were used in the walls, and burnt brick was employed in the water conduits and gardens. The dimensions of the bricks are given on p.

Similar features were found in the Coptic Town of Armant,⁹⁷ consisting of rough mud-brick construction with floors, sills and stair treads of burnt brick. The stairs were built over vaults of type x1, the joints in which were filled with lime mortar. A variety of bonding systems were used in the brickwork, these being A1, A2, A3, B3, C1, C4 and C7, of which type C1 was the most common.⁹⁸

Edfu.

The houses of the Graeco-Roman town at Edfu⁹⁹ are built of mud bricks in A1, A2 or A3 bonding, the dimensions of these bricks being shown in the table on page 103. Vaults were generally used for the roofing of cellars and ground-floor rooms; the majority of these were of x1, d1, cd1 or bd1 form, composed of slightly curved bricks measuring 39–42 x 16–17 x 7–8 cm.¹⁰⁰ Apertures were left in the crown of the vault, for both ventilation and light.¹⁰¹ Vaults were also used to support the stairways, the steps of which were sometimes reinforced with stone.¹⁰² Burnt brick was only used to a limited extent in the Graeco-Roman town, usually in places subject to wear or damp, such as drains, thresholds and baths. In the Byzantine and Coptic remains burnt brick is more common, and it is occasionally found in the arches over the windows.¹⁰³ Another feature of these later houses is the increase in the use of C1 and C3 bonding, which tends to replace the type A bonds of the earlier structures.¹⁰⁴ The doorways in the houses of the Graeco-Roman period and later are covered by arches of type c1 or bc1.¹⁰⁵ Pointed arches are found occasionally in the Graeco-Roman buildings, but are more common in the Byzantine levels, where they are used over stairways and narrow passages.¹⁰⁶

94. *Ibid.*, Pl. 43C.

95. *Ibid.*, 47.

96. R. Mond & O.H. Myers, *The Baqaria*, I, 179–85 & Pls. V, CI–CII.

97. R. Mond & O.H. Myers, *Temples of Armant*, 36–48 & Pls. IV, XII XIII, XXXIV–XXXIX.

98. Mond, R. & Myers, O.H., *op. cit.*, 40–6.

99. Michalowski, K. *et al.*, *Tell Edfu*, I (1937), 82–98; II (1938), 6–13, 25–9; III (1939), 111–149 & Plan IV. Alliot, M., *Tell Edfu*, 4–13.

100. Alliot, *op. cit.*, 12.

101. Michalowski, *op. cit.*, III, 120–1.

102. *Ibid.*, 139 & Plan IV.

103. *Ibid.*, 153–4.

104. *Ibid.*, 153, fig. 100; Alliot, *op. cit.*, 4–5.

105. Michalowski, *op. cit.*, III, 134 & Plan IV.

106. *Ibid.*, Plan VI.

Elephantine.

The houses of Elephantine, which date from the Graeco-Roman and Coptic periods, have mud-brick walls varying from 50–70cm in thickness, built in A2 and A3 bonding.¹⁰⁷ Bricks on edge are often used for the foundations of the walls or for levelling the brickwork.¹⁰⁸ In a few cases, the walls were built in concave beds, or had remains of timbering on the faces and at the angles,¹⁰⁹ but the widespread use of wood seen in the Graeco-Roman houses in the Fayum is not found at Elephantine. The cellars were roofed with d1 vaults formed of large, thin bricks, the joints on the outside of the curve being filled with stones and potsherds.¹¹⁰ Vaults were also employed beneath the stairs, where they are of x1 form, some examples being constructed of burnt bricks measuring 26 x 11–13 x 4.5cm.¹¹¹

SUMMARY: BRICKWORK IN GRAECO-ROMAN HOUSES.

Location	Bonds	Brick Size(cm)	Notes
<i>Timuls:</i> ¹¹²	—	—	Houses with mud- and burnt-brick construction.
<i>Qasr Qarun:</i>	—	—	Timber in brickwork and over windows.
<i>Philadelphia:</i>	—	—	Roofs of palm-logs or vaults.
<i>Theadelphia:</i>	—	—	Roofs of bricks over logs. Mud brick construction.
<i>Karanis:</i>	A1 A2 A3 C1 x1 d1	26–27 x 12–13.5 x 7.5–11 (Vaults)	Extensive timbering in walls and around doors & windows. Corners of houses protected with wood. Some walls built in concave courses. Palm-logs for roofing, but vaults over cellars.
<i>Dime:</i>	A2 A3 x1 d1	29 x 14 x 11 30 x 15 x 11	Timbering of walls, doors and corners. Vaulted cellars. Walls of concave type.
<i>Hermopolis:</i>	A1 C1	33 x 15–8 x 7–11 30 x 12 x 8 22–24 x 10–12 x 6–7 (Copt.)	Burnt bricks mostly in Coptic levels.
<i>Medamud:</i>			Floors, drains & baths of burnt brick. Special round bricks for columns.
<i>Medinet Habu:</i>			
Roman houses:	A2 A3 A18 C6	31–32cm long	Mud-brick houses, probably wood-roofed. Bathrooms lined with burnt bricks.
Coptic houses:	A1 A2 A3 C1 C3 x1 d1 c1 bc1 bx1	30 x 14 x 6 to 31 x 15 x 7	Vaulted rooms and arched doors, windows & niches. Few burnt bricks for foundations, sills, steps, cupboard niches & vaults.
<i>Armant:</i>			
Roman Village:	A2 C1	29 x 14.5 x 9 31 x 15 x 8 31 x 12 x 9 33 x 15 x 7 28 x 13 x 7.5 31 x 16 x 7 33 x 16 x 7 34 x 17 x 8.5 31 x 16.5 x 11 34 x 16 x 7	Mud Bricks. Burnt Bricks.

107. Grossmann, P., *MDIK* 26 (1970), 126, 129 & Pls. XL–XLI.

108. Honroth, W., *ZAS* 46 (1969), 18–9.

109. Grossmann, P., *MDIK* 26 (1970), 129; 28 (1972), 170 & Pl. XLIV.

110. *idem.*, *MDIK* 26 (1970), 122 & Pl. XLI b.

111. *ibid.*, 133.

112. Ochsenschlager, E. L., *JARCE* 6 (1967), 32–4.

Location	Bonds used	Brick sizes (cm)	Notes
Coptic Town:	A1 A2 A3 B3 C1 C4 C7	—	Rough mud-brick construction. Burnt brick for floors, sills & stairs.
<i>Tod</i> : ¹¹³	—	—	Romano-Coptic houses with burnt brick floors, wells & baths.
<i>El-Kab</i> : ¹¹⁴	—	—	Graeco-Roman village in temple area. Houses with vaulted cellars.
<i>Edfu</i> :	A1 A2 A3 C1 C3	37 x 17 x 10 33 x 18 x 5 31-33 x 15-18 x 10-14 34-35 x 16-18 x 11-13 36 x 17 x 12.5	Mud-brick houses, with burnt bricks for special uses. Many vaulted rooms & arched doors. Class C bonds more common in Coptic remains.
<i>Elephantine</i> :	A2 A3 d1 x1	26 x 11-3 x 4.5 (Burnt) mud-bricks 30-33 long.	Vaults over cellars and beneath stairs. Few cases of timber in brick walls, but not common. Some walls built in concave courses. Thickness of house walls averages 50-70cm.

113. Bissin de la Roque, F., *Tod*, 30-53.

114. Capart, J., *Fouilles de El-Kab, Documents*, 28 & Pls. 39-40.

CHAPTER EIGHT: FORTRESSES AND DEFENSIVE TOWN WALLS

1. The Archaic Period.

The evidence for the existence of fortified settlements given by representations on archaic palettes and sealings has already been discussed (page 5) and need not be repeated here. The early "fort" at Hierakonpolis¹ has certain features of a defensive character, such as the double outer wall and the fortified gateway, but this building probably had a ritual or funerary purpose like the Second Dynasty enclosures at Abydos. The bricks of the Hierakonpolis "fort" vary from 25 x 12 x 9cm to 30 x 14 x 7cm in size, and they are laid in A2 or A3 bonding.² These small dimensions are typical of the Archaic Period, and resemble the bricks of the town wall at Hierakonpolis, which measure 24.5 x 14 x 7cm. This wall³ was originally 5.15m in thickness, built in Class A bonding, but at a later date it was enlarged by the construction of another wall, 2.50m thick, at a distance of 1.85m in front of it. The gap between the two walls was then filled with earth to form a single wall of 9.50m. The second wall was built of bricks 28 x 14–16 x 8.5–10cm in size, and may have been decorated with niches on its outer face.

2. Old and Middle Kingdom Fortifications.

Several parts of the Old Kingdom town wall of Elephantine have been discovered at that site, built of small mud-bricks in Class A bonding. The South-East section⁴ of the wall is founded on a substructure of thin walls, which were built in order to fill up the irregular hollows in the granite bedrock. These foundation walls are bonded A2(1.5) or A3 (2.0), whilst the main wall above them is four bricks across and is built in A3 bonding, except for a base layer of bricks on edge. The bricks themselves measure 26–27 x 11–13 x 6–7cm, and they are laid in mud-mortar. In the Southern part of the site stands another section⁵ of the same wall, (bricks 27 x 14 x 7.5cm) overbuilt by a later wall of the New Kingdom. More remains of the early wall⁶ lie to the East of the temple of Khnum, where there are four levels of building, some of which appear to represent repairs of Middle Kingdom date. Here also the bonding is Class A, and the bricks are 24–27 x 11–13 x 6.5cm in size.

At El-Kab the town wall⁷ was circular, and formed of two parallel thin walls with a rubble filling between, although Somers Clarke believed⁸ that they were two independent walls, as in the early "fort" of Hierakonpolis. They stand 4.88m apart and are 2.44 and 2.74m thick respectively, both constructed of bricks 35 x 13 x 6cm in size. The date of the town enclosure is not certain, but it is presumed to belong to the Middle Kingdom.⁹

Remains of town-walls of this period have been found at Edfu, overlying a cemetery of the Old Kingdom.¹⁰ The earliest wall was built in the First Intermediate Period and was reinforced during the Middle Kingdom. It does not follow a straight course, but contains a number of right-angle bends, which project outwards in the manner of bastions.¹¹ Later in the Middle Kingdom a new enclosure was built on a straight plan. All these walls are constructed in Class A bonding, probably A3, as is usual in thick masses of brickwork.

Since the available information on fortifications within Egypt is so slight at this date, I have included below a brief description of the construction of the outer walls of the Nubian fortresses. Some of these features belong to the New Kingdom, but they are stated here to avoid dividing the material concerned with a single group of buildings.

Kuban.¹²

Timbers occur in the main walls every eighth course, laid transversely, resting on a layer of reed-matting which fills the horizontal joint. The bricks are 32 x 16 x 10cm in size.

1. Quibell, J.E. & Green, F.W. *Hierakonpolis*, II, 19-20 & Pl. LXXIV.

2. *ibid.*, 20. Also Garstang, J., *ASAE* 8 (1907), Pls. V-VI.

3. Fairervis, W.A., *JARCE* 9 (1971-2), 15 & Fig. 9.

4. Jaritz, H., *MDIK* 26 (1970), 134-6.

5. Stadelmann, R., *MDIK* 27 (1971), 200-1.

6. Jaritz, H., *MDIK* 26 (1970), 91-3.

7. Somers Clarke, *JEA* 7 (1921), 59.

8. *ibid.*, 59.

9. *ibid.*, 59.

10. Michalowski, K., *Tell Edfou*, III' (1939), 103-6 & Plans II-III.

11. *ibid.*, 103 & Plans II-III.

12. Emery, W.B. & Kirwan, L.P., *Exc. and Survey between Wadi es-Sebua & Adindan*, 26-33.

Buhen.

The buttressed walls of the fort are built of mud bricks measuring 32 x 15 x 8cm,¹³ and wooden beams occur at intervals in the structure. Woolley thought that certain parts of the wall contained large compartments, which were either filled with sand or used for storage,¹⁴ but more recent excavations have shown this conclusion to be incorrect since the main walls consist of solid brickwork.

Mirgissa.¹⁵

In the heart of the walls the bricks are laid carelessly, but in spite of this apparent irregularity the deviation of the courses from a true plane is only ± 2 cm, this levelling probably being accomplished by sighting on the horizon. Similar accuracy is seen in the spacing of the layers of wooden beams; these are separated by 12 courses of bricks, a distance which in each case measures 1.30m, with a maximum error of under 2cm. These beams are 15–20cm in diameter, and they always rest on a layer of reed-matting. In the thick walls and buttresses there is a system of air channels through the brickwork at various levels, formed of passages two bricks high by one brick wide.¹⁶ A detailed study of the dimensions of the bricks used in the fortress has been made by Hesse,¹⁷ based on the measurement of a large number of examples, most of which were between 30cm and 34cm in length.

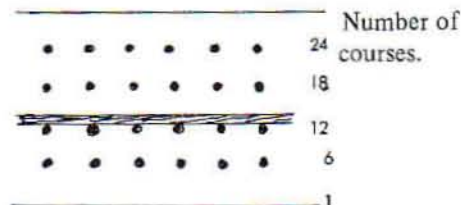
Askut.¹⁸

The outer wall has buttresses along the face, both these and the wall itself being reinforced with timbers laid along and across the brickwork. The bricks of this fort measure 32 x 15–16 x 8–9cm.

Shalfak.¹⁹

A great quantity of wood was employed in the main walls, transverse beams being found at every sixth course of brickwork, whilst longitudinal timbers occur at the thirteenth course. The latter timbers rest upon the logs in the course immediately below, as shown in Fig.68. The brick size is 33 x 16 x 11cm.

Fig.68 Timbering of wall, Shalfak.



Uronarti.²⁰

Timbering occurs in the walls and in the buttresses, usually with a layer of beams along the face of the wall in the course above a row of transverse logs (Fig.69). Reed-matting is also employed, between every sixth course of brickwork.

Fig.69 Timber in Wall, Uronarti.



Semna.²¹

The walls of the fort stand on granite rubble, as at Kumma on the opposite side of the Nile, and consist of mud-bricks 32 x 14 x 8cm in size. Timber was used extensively in the brickwork, the beams being set both along and across the walls, and layers of reeds occur at every fifth course.²²

13. Somers Clarke, *JEA* 3 (1916), 163.

14. Woolley, L. & Melver, D.R., *Buhen*, 119.

15. Dunham, D., *Second Cataract Forts*, II, 154-7.

16. *ibid.*, Pl.LXXXIII A-B.

17. Hesse, A., *Mirgissa*, I, 102-114.

18. Badawy, A., *Kush*, 12 (1964), 50.

19. Dunham, D., *Second Cataract Forts*, II, 121, & Pl.LIII A.

20. *ibid.*, 21-2 & Pl. XIV A-B.

21. *ibid.*, I, 5-6 & Pl.4 B.

22. Somers Clarke, *JEA* 3 (1916), 178.

*Kumma.*²³

The walls are built in Class A bonding on a foundation of granite rubble. Beams, 10–15cm in diameter, run along and across the walls at frequent intervals, and reed-matting is found between every fourth course. The dimensions of the bricks are 32 x 15 x 8cm,²⁴ as at Buhen and Askut.

*Kerma.*²⁵

'The Lower Deffufa' measures 100 x 50 cubits (52.20 x 26.70m) and is built of mud-bricks 35 x 17 x 8cm and 35 x 17 x 12cm in size. The faces of the walls show the appearance of A1 bonding, but internally there is an alternation of four header courses with four stretcher courses. Wooden beams occur at levels 5m apart, set crosswise through the brickwork.

3. New Kingdom Fortifications.

Examples of defensive town walls or fortresses are rare at this period, except in the Nubian forts described above. The enclosure walls of the temple of Ramesses III at Medinet Habu, which are designed in a defensive style, have also been discussed elsewhere (see above, page 70).

The town wall of Edfu was rebuilt at three successive periods during the New Kingdom, one of these walls, numbered CS X, being 1.95m thick.²⁶ It seems that all these structures were built in A2 or A3 bonding,²⁷ but no technical details are available.

A New Kingdom town-wall has been found at Elephantine, built of bricks 36 x 18 x 9cm in size with mud-mortar in the horizontal joints. In the Southern part of the site, this wall overlies that of the Old Kingdom,²⁸ and the alignment of the wall suggests that it is continuous with other remains in the South-West part of the island, where a number of stratified walls have been found.²⁹ These ruins have not yet been precisely dated, but it seems certain that one of the earlier levels will prove to be the continuation of the New Kingdom wall. Further traces of this wall stand on the East of the site,³⁰ consisting of two levels of building, both of which are formed of bricks measuring 36 x 18 x 9cm, as in the Southern section.

Defensive town-walls of the New Kingdom occur in Nubia, around the Egyptian settlements at Sesebi and Amara West.³¹ These walls have buttresses along the outer face, and at the latter site the bricks were stamped by Seti I. The wall of Sesebi was 4.60m thick, with buttresses 3.15m across projecting 2.65m from the face. A different type of enclosure is found at Aneiba,³² where the New Kingdom town was surrounded by a plain brick wall without buttresses, protected by a dry ditch in front. This ditch, the sides of which were lined with brickwork, was overlooked by the low ramparts which ran along the foot of the main wall of the town. The latter wall was 5m thick and stood on a foundation course of bricks on edge, with a sloping socle on the outer face.

4. Fortifications of the Twenty-First to Thirtieth Dynasties.

Deffeneh.

Psammetichus I established a fortified camp at this site in the North-East Delta, consisting of a roughly square building standing on a high foundation of brickwork.³³ Some of the compartments in the platform were domed over to form store-cellars, whilst others were merely sand-filled to provide a base for the structures above.³⁴ A few chambers were filled up solid with brickwork. The outer surfaces of the walls had received two or three coats of plaster, and the bricks were laid in mud-mortar. Outside the citadel was a pavement of brick, beneath which some burnt bricks, possibly of Ramesside age, were discovered, measuring 32 x 15.5 x 8cm.³⁵ The sizes of the bricks in the fort itself are given on page 108.³⁶

23. Dunham, *op. cit.*, I, 114-5.

24. Somers Clarke, *JEA* 3 (1916), 174.

25. Reisner, G.A., *Kerma*, I-III, 22-3.

Despite Reisner's opinion, this building was probably not a true fortress.

26. Michalowski, K., *Tell Edfou*, III (1939), 104-6 & Plans II-III.

27. *ibid.*, Plan II.

28. Stadelmann, R., *MDIK* 27 (1971), 201.

29. *ibid.*, 198-200.

30. Jaritz, H., *MDIK* 26 (1970), 94 & Plan on p.92

31. Blackman, A.M., *JEA* 23 (1937), 146 & Pl. XIII.

Fairman, H.W., *JEA* 25 (1939), 140.

32. Steindorff, G., *Aniba*, II, 17 & Pls. 6, 8.

33. Petrie, W.M.F., *Tanis, II, Nebesheh & Deffeneh*, 54. & Pl. XLIV.

34. *ibid.*, 53.

35. Petrie, W.M.F., *op. cit.*, 58.

36. *ibid.*, 95.

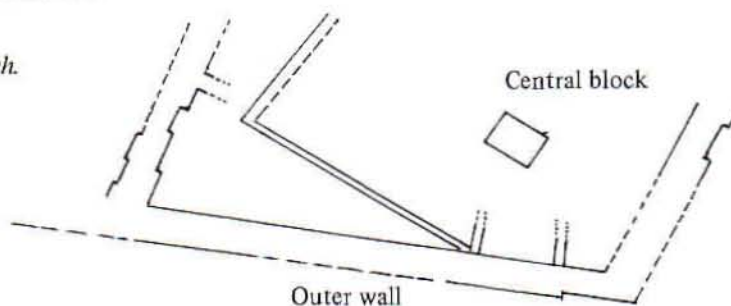
Naukratis.

A similar building to the camp of Deffeneh was discovered in the temple temenos at Naukratis, built in the same manner over a platform of domed chambers.³⁷ The lowest entrance to this structure is situated at a point over 5m above the ground, which indicates a defensive purpose, and even in its ruined state the building is still 10m high. The bricks are of a size common in Saite times, measuring 41.5 x 21 x (?)cm.

Abu Roash.

A large building was excavated at this site by Macramallah, who described it as a fort, and dated it to the Middle Kingdom,³⁸ although both the identification and the dating are open to doubt. The monument consists of an enclosing wall, 12m in thickness, within which is a denuded block of brickwork. (Fig.70). No timber ties were found in the structure of the great wall, which is composed of mud-bricks 39 x 19.5 x 10.5cm — 44 x 22 x 14cm in size, laid in sand.³⁹ Along the face are a series of recessed and projecting sections, some of the former having buttresses built up against the lower courses, formed by stepping back the courses of bricks.⁴⁰ Macramallah states that the bricks are laid in horizontal courses, but then goes on to say that the "beds rise up towards the angles of the panels", ⁴¹ and the drawing given in his report ⁴² shows some of the sections of brickwork to be concave. The construction within the enclosed area, apparently a solid mass, is also built in concave courses of brickwork.⁴³

Fig. 70 Plan of "Fort" at Abu Roash.



What is the true nature of this building? It cannot be a fort, as Macramallah supposed, since it does not correspond to any known Egyptian fortifications, and the constructional details are not in accord with this identification. Walls built in concave beds are not used in a fortress, nor, indeed, in any kind of secular building in Pharaonic times. It is more probable that this structure is some kind of religious monument, since the central mass could have been the foundation of some form of small temple or chapel, enclosed by the outer wall.

The reasons given by Macramallah ⁴⁴ for dating the building to the Middle Kingdom are not convincing, and the presence of a drain formed of Roman amphorae on the site ⁴⁵ would rather indicate a late age, although the drain and the monument are not necessarily contemporary. However, the construction of the solid central block of brickwork in concave courses is a technique so far not encountered prior to the Late-Period, ⁴⁶ to which, therefore, the building is possibly to be ascribed. It could just be of Ptolemaic date, although this is less likely since the dimensions of the bricks would then be exceptionally large, whilst they agree perfectly with bricks of the Twenty-Sixth to Thirtieth Dynasties.

Memphis.

At the North end of the Palace of Apries was a fortified camp or citadel, ⁴⁷ built on domed compartments in a platform of brickwork, as in the forts of Deffeneh and Naukratis.

37. Petrie, W.M.F., *Naukratis*, I, 24-6 & Pls. XLII-XLIII.

38. Macramallah, M.R., *ASAE* 32 (1932), 161-173 & Pls. I-IV.

39. *ibid.*, 163-5.

40. *ibid.*, 165 & Pl. II.

41. *ibid.*, 164-5.

42. *ibid.*, 166, Fig.1.

43. *ibid.*, 164 note 1 & Pl. III, 3.

44. Macramallah, M.R., *op. cit.*, 171-3.

45. *ibid.*, 167 & Pl. III, 2.

46. Examples occur in the foundations of small peripteral chapels at Tanis and El-Kab.

47. Petrie, W.M.F., *The Palace of Apries*, 1. *Idem*, *Memphis*, I, Pl. I.

El-Hibeh.

The town of El-Hibeh is surrounded by a wall 12.60m in thickness, and at its Northern end is a fort containing stamped bricks of Pinudjem I and Menkheperre.⁴⁸ The latter high-priest also built forts near Shurafa and at Qus and Gebelein,⁴⁹ but apart from the presence of stamped bricks no details of these buildings are available. At Gebelein there were forts on both sides of the gebel,⁵⁰ that on the East hill having walls built in Class A bonding with reed-matting between the courses of bricks.

Medinet Habu.

The enclosure wall of the temple of Ramesses III at Medinet Habu was rebuilt in the Twenty-First Dynasty by Pinudjem I,⁵¹ with bricks measuring 36 x 18 x 10cm and 42 x 20 x 12cm, the latter being re-used. A tower was constructed on the rounded South-West corner, and a new gate was added on the West side.

Further reconstruction took place in the Twenty-Second Dynasty,⁵² with re-used bricks from the buildings of Ramesses III and from the nearby palace of Amenhotep III at Malqata. The purpose of the wall was no longer concerned with the temple, but was to protect the town which had developed within the enclosure.

SUMMARY: FORTS OF THE LATE PERIOD.

Location	Bonds	Brick Sizes(cm)	Notes
<i>Bethpelet:</i>			
Fort of Sheshonk I: ⁵³	—	43—53 long.	Outer wall over 5m thick.
<i>Gerar:</i>			
Fort of Psammetichus I: ⁵⁴		37 x 19 x 14 to 40.5 x 20.5 x (?) 33 x 33 x (?) 35 x 34.5 x (?) 36 x 36 x (?) 37 x 34 x 14	Similar construction to fort at Deffeneh. Square bricks due to influence from Mesopotamia.
<i>Deffeneh:</i>			
Fort:	—	41 x 20 x 12.5 41.5 x 20 x 11.5 41.5 x 20.5 x 10.5—11 44 x 22 x 11 44 x 22 x 13 41 x 20.5 x 12.5 41 x 20.5 x 11 36 x 18 x 9	Fort stands on a high platform of cellular brickwork. Some of the chambers in this foundation were domed over.
<i>Naukratis:</i>			
Fort in Great Temenos:		41.5 x 21 x (?)	Similar to fort of Deffeneh.
<i>Abu Roash:</i>			
"Fort"	—	39 x 19.5 x 10.5 to 44 x 22 x 14	Large enclosure around remains of a building. Almost certainly not a fort; possibly some kind of temple.

48. Kamal, A., *ASAE* 2 (1901), 85.

49. Kitchen, K.A., *Third Intermediate Period*, 269-70.

50. Information kindly supplied by Dr. B.V. Bothmer.

51. Hölscher, U., *E.M.H.*, V, 3-4.

52. *ibid.*, 6.

53. Petrie, W.M.F., *Bethpelet*, I, 20 & Pl.LIX.

54. Petrie, W.M.F., *Gerar*, 7-8 & Pl.XI.

Location	Bonds used	Brick sizes (cm)	Notes
<i>Memphis:</i> Camp N. of Palace of Apries:	—	—	Built on cellular platform of brickwork.
<i>El-Hibeh:</i>	—	41 x 18 x 10.5	Stamped bricks of Menkheperre and Pinudjem I.
<i>Medinet Habu:</i> Rebuilding of Pinudjem I:	—	36 x 18 x 10 42 x 20 x 12	Ramesside bricks, re-used.
XXIIInd. Dyn. rebuilding:	—	—	Repairs to enclosure wall with re-used bricks.
<i>Gebelein:</i>	—	43 x 23 x 10	Forts of Menkheperre on either side of the gebel, built of stamped bricks.

5. Graeco-Roman Fortifications.

Medinet Habu.

The old enclosure wall of Medinet Habu was repaired in the Roman period,⁵⁵ and towers were built at the South-East and North-West corners. Re-used bricks were employed in the lower courses of these structures, measuring 44 x 20 x 11cm and 36 x 17 x 10cm, whilst the higher levels were built of Roman-age bricks 32 x 14 x 10cm in size. The bonding of this brickwork is type C1, at least on the outer faces of the walls, as can be seen in the view of the North-West tower in Plate 56B.

El-Kab.

At this site there was a small Roman fort, built on square plan with bastions at each corner.⁵⁶ Most of the construction is composed of mud-brick, but in the pavements and the few surviving vaults a few burnt bricks occur. The pavements are formed of bricks laid in even rows, or, occasionally, in a herringbone pattern.⁵⁷ In the surviving walls the bricks are laid as stretchers, with a layer of edger-headers every fourth course. The sizes of the bricks are given in the chart on page 110.

Edfu.

A defensive wall was constructed on the top of the town-mound in Ptolemaic times, with bricks measuring 31 x 17 x 11cm, laid in Class A bonding.⁵⁸ The wall was repaired and strengthened during the Roman period, at which time rounded bastions were added along the outer face.⁵⁹ Some C1 bonding occurs in this reconstruction work, and the dimensions of the bricks are 31 x 16 x 10cm — 33 x 17 x 11cm,⁶⁰ although some of these may be re-used. In the second century A.D., a new wall was built to the West of the previous one, with bricks 32 x 16 x 11cm in size.⁶¹

Elephantine.

In the South-West part of the site of Elephantine are the stratified remains of town-walls of various dates,⁶² the most recent of which probably belongs to the Roman period. This dating is supported by the fact that this wall is built of small bricks laid in C1 bonding, which only becomes common in brickwork of Roman and Coptic age.

55. Hölscher, U., *E.M.H.*, V, 36.

56. Badawy, A. in Capart, J., *Fouilles de El-Kab-Documents*, 81-2.

57. Badawy, A., *ASAE* 46 (1947), 367.

58. Michalowski, K., *Tell Edfu*, III (1939), 118 & Pls. IV-V.

59. *ibid.*, 126, 148-9 & Plan IV.

60. *ibid.*, 148, Fig.89, & Plan IV.

61. *ibid.*, 143 & Plan IV.

62. Haeny & Jaritz, *MDIK* 27 (1971), 198-200.

Kharga.

At Ed-Deir in Kharga Oasis is a Roman fortress known as Kastell ed-Deir, consisting of a square enclosure with defensive towers at the angles and along the sides.⁶³ The outer walls are approximately 4m in thickness and are reinforced by timbers set transversely and longitudinally in the brickwork.⁶⁴ Most of the construction is composed of mud-bricks measuring 31 x 16 x 11cm, but the sides of the entrance gateway on the West side are formed of burnt bricks.⁶⁵ This entrance was originally roofed with a vault, constructed of burnt bricks 26 x 12 x 6cm in size, the broad surfaces of each brick being scored with several shallow grooves.⁶⁶

SUMMARY: GRAECO-ROMAN FORTIFICATIONS

Location	Bonds	Brick Size(cm)	Notes
<i>Shurafa:</i> ⁶⁷	—	—	Roman fort with double outer wall and towers at corners and on E. side. Brick walls founded on stonework.
<i>Hu:</i> ⁶⁸	—	—	Temple-enclosure made into Roman fort, by addition of towers at angles.
<i>Dendera:</i> ⁶⁹	A ? C1	—	Temple-enclosure repaired in Coptic and early Arab times, to serve as town-wall. Tower built beside East gate, and another at S.W. corner.
<i>Luxor:</i> Roman fort around old temple: ⁷⁰	—	—	Semicircular towers along walls, square towers at angles. Triangular burnt bricks for columns.
<i>Medinet Habu:</i> Town wall:	—	—	Roman repairs to temple wall of Dyn. XX.
Towers:		44 x 20 x 11(re-used) 36 x 17 x 10(re-used) 32 x 14 x 10	Square towers at S.E. & N.W. corners, built in Class C bonding.
<i>El-Kab:</i> Roman fort:		34 x 17 x 8 32 x 16 x 7 22 x 11 x 5 32 x 14 x (?) (burnt)	Square fort with corner towers. Burnt brick only in floors & vaults.
<i>Edfu:</i> Ptol. & Roman wall:	A3 C1	31 x 17 x 11 34 x 17 x 11-2 31 x 16 x 10 to 33 x 17 x 11 32 x 16 x 11	Semicircular bastions added to wall in Roman times.
Late Roman wall: <i>Kharga:</i> Roman fort:	—	31 x 16 x 11 26 x 12 x 6	Square fort of mud-brick construction, with towers at corners and along walls. Timber reinforcement in brickwork. Smaller size of bricks are burnt, from vaulting over gate.

63. Naumann, R., *MDIK* 8 (1939), 2-3.

64. De Bock, W., *Materiaux.....arch. chrét.*, 2.

65. *ibid.*, 2, 4.

66. *ibid.*, 2.

67. Petrie, W.M.F., *Heliopolis, Kafr Ammar & Shurafa*, 41 & Pl. XLVII.

68. Petrie, *Diospolis Parva*, 54-5 & Pl. XXIV.

69. Chassinat, E., *Dendera*, I, Pls. VI & IX.

70. Lacau, P., *ASAE* 34 (1934), 17-20.

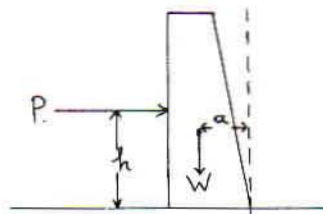
CHAPTER NINE: BRICK WALLS.

1. Retaining Walls.

A great deal of Ancient Egyptian building involved the construction of brick walls to hold back different levels of sand or gravel, since these materials were frequently employed as filling, or for levelling. Walls built for this purpose function in the same manner as a dam or dyke, and the loose filling behaves as if it were a fluid. The pressure upon the retaining wall is clearly proportional to the height of the rubble which rests against it, and this lateral thrust tends to make the wall overturn or slide, but is resisted by the weight of the brickwork. The Egyptians seem to have realized at an early date that a considerable saving in material could be made, without loss of stability, by creating a wall of trapezoidal rather than rectangular section, and a good example of this technique is afforded by the great retaining wall around the solar temple of Neuserre at Abu Gurab.¹ Less massive walls of trapezoidal form are common among the brick mastabas of the Archaic Period and Old Kingdom.

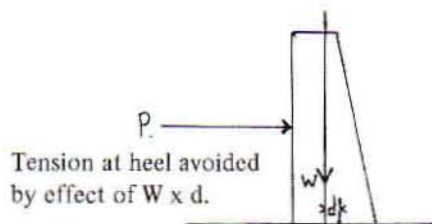
For a wall of this type to be stable, certain conditions have to be fulfilled, which can be explained by reference to the diagram below (Fig.71). The weight of the brickwork, acting downwards from the centre of gravity, must be sufficient to ensure that $W \times a$ is greater than $P \times h$, otherwise the wall will collapse. An additional requirement is that there should be no tension developed in the structure of the wall, since brickwork has poor tensile strength.

Fig.71 Wall under lateral pressure.



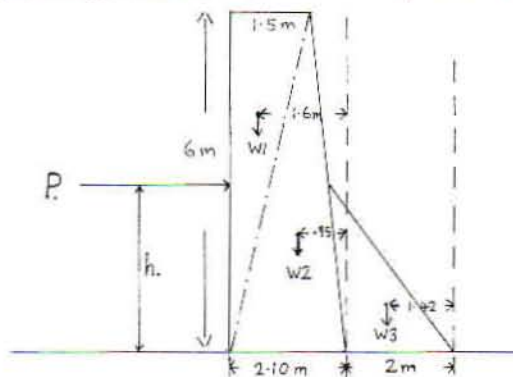
In a wall exposed to side thrust, the tendency is for tensile stress to occur at the heel of the wall, and compressive stress at the toe. The formation of such tension at the heel is avoided by the effect of the load W , which not only produces a compressive stress over the entire wall base, but also creates a bending moment of $W \times d$, where d is the distance between a vertical line through the centre of gravity of the wall section and the centre of the base (Fig.72). This bending moment is opposite to that produced at the heel by the pressure of the filling, and therefore tends to cancel out the tension at that point.

Fig.72 Stress in a Retaining Wall.



It is of interest to apply these rules to an Ancient Egyptian construction. Figure 73 shows a section of the great retaining wall which surrounds the temple of Isis-mother-of-Apis at North Saqqara,² with the buttress on its outer face. This wall is preserved to a height of 4m, but the original height must have been about 6m, as shown in the

Fig.73 Section of Retaining Wall at North Saqqara.



1. See above, p.62.

2. Emery, W.B., *JEA* 53 (1967), 144-5. *Idem.*, *JEA* 55 (1969), Pl.XI.

drawing. Taking the density of the brickwork to be 1250 kg/m,³ and working with a 1m section of the wall, the following calculation can be made:

Stability of the wall alone:

$$W1 = 0.75 \times 6 \times 1250 = 5625 \text{ kg}$$

$$W2 = 1.05 \times 6 \times 1250 = 7875 \text{ kg}$$

$$\text{Total } W = 13500 \text{ kg}$$

$$\begin{aligned}\text{Moment at toe of wall} &= W1 \times 1.6 + W2 \times 0.95 \\ &= 5625 \times 1.6 + 7875 \times 0.95 \\ &= 9000 + 7481(.25) \\ &= 16,481(.25) \text{ kg/m}\end{aligned}$$

Therefore the wall is stable so long as the pressure upon it is less than 16,481 kg/m.

Stability of added buttress:

$$\text{Taking the buttress} = 1 \times 3 \times 1250 = 3750 \text{ kg}$$

$$\text{Moment at toe} = 3750 \times 1.42$$

$$= 5325 \text{ kg/m}$$

The buttress can withstand a pressure up to 5,325 kg/m

The use of buttressing on a retaining wall clearly gives greatly improved strength in return for a small extra outlay of materials, and the process is common in Egyptian brickwork.

In some cases retaining walls were constructed by the use of loose filling contained between two parallel walls of brick, a good example of this type being found in the terrace temple of Amosis I at Abydos.³ The weight of the internal filling acts in such a way as to aid the stability of the whole structure, by preventing the collapse of the brick casing.

Another form of wall is that built on a sinusoidal plan, as exemplified around the South pyramid of Mazghuneh,⁴ although this technique is not restricted to the Middle Kingdom as has been stated.⁵ A detailed study⁶ of the advantages of this form of building over a conventional retaining wall of the same thickness has revealed that an improvement of 100% in resistance to side-thrust is obtained. An important point concerning walls of this type is the fact that they are relatively thin; the most substantial examples around the pyramids of Mazghuneh⁷ and South Saqqara⁸ are only 1.05m and 0.65m across, whilst the wavy walls used in domestic buildings very often have a thickness equal to the width of a single brick.⁹ This would seem to indicate that the Egyptians employed walls of this form when they wished to combine rapid construction with a fair degree of stability. In the case of the extremely thin walls the wavy construction would give rigidity to the brickwork, just as modern sheet iron is corrugated to improve its strength. The bonding of such thin walls is A1 or X1, whilst great retaining walls are usually bonded A2 or A3 like thick walls of other types. More variation in bonding occurs in the casing-walls of mastabas and in the lining of tomb-pits, as shown in the charts on page 14-15, 21, 24-5 and 33-7.

2. Great Walls.

Construction in Level Courses of Brickwork.

Brick walls of fairly massive dimensions are common in Egyptian architecture in both secular and religious buildings and throughout Pharaonic times they show great uniformity in construction. They are most frequently built in A3 bonding, so their internal structure consists entirely of headers. In cases where the thickness of the wall is not equal to an even number of brick-lengths the bonding is A2, but this change has no real effect on the mass of bricks in the heart of the wall. Probably these bonds were employed so frequently because of their simplicity; the fact that all the bricks of the internal work were laid as headers would considerably speed up the process of construction. Good examples of this type of bonding in thick walls are found in the enclosures of the royal mortuary temples at Thebes, and in the early dynastic "fort" of Hierakonpolis,¹⁰ although in the latter case it is necessary to ignore the palace-facade panelling.

3. Currelly, C.T., Ayrton, E.R. & Weigall, A.E.P., *Abydos*, III, 33 & Pl.LIII.

4. Petrie, W.M.F. & Mackay, E., *The Labyrinth, Gerzeh & Mazghuneh*, Pl.XXXIX.

5. Jéquier, G., *Deux Pyramides du Moyen Empire*, 55 & Pl. XV.

6. Vercoutter, J. & Hesse, A., *Mirgissa*, I, 97-101.

7. Petrie, W.M.F. & Mackay, E., *op. cit.*, 47.

8. Jéquier, G., *op. cit.*, 55-6.

9. See p.95.

10. Quibell, J.E. & Green, F.W., *Hierakonpolis*, II, 20. Garstang, J., *ASAE* 8 (1907), Pls.V-VI.

It is common to see bricks laid on their edges, as headers, in various parts of Egyptian walls; these are not merely careless irregularities, but are the result of a deliberate technique of adjusting the levels of the courses. This process is not restricted to thick walls, but can be found everywhere in Egyptian brickwork. Sometimes the bricks are tilted over so as to raise one section of a course more than another. (Fig. 74). Further adjustment of the levels was made by varying

Fig. 74 Levelling by use of bricks on edge.



the thickness of the mortar in the horizontal joints, but careful mortaring is only found on the exterior surfaces of the walls. There is rarely any mortar in the inner structure and the vertical joints are often quite wide, perhaps to aid drying of the brickwork, like the wide, gravel-filled joints employed in bonds A12-A15. Layers of reed-matting occur in walls built in level courses, but wooden ties are not so common as in the undulating type of wall (see below). The Nubian fortresses, however, are an exception to this rule, since their main walls have very extensive and regular timbering.¹¹ The occurrence and distribution of reed layers and wooden beams is discussed more fully in Chapter 13.

Choisy has suggested¹² a complicated process for the construction of a thick wall in level courses of brickwork, in order to solve the problem of raising the materials to the necessary height without the use of scaffolding. The whole explanation is superfluous, since the workmen would have gained access to the top of the wall by means of short ramps of sand or earth, according to the traditional Egyptian method of building.

The construction of brick pylons is very similar to that of great walls in terms of bonding, use of reed-matting, and the mortaring of the joints (Pl. 47A). A sloping face was produced by stepping each layer of bricks back slightly, and then smoothing the surface with plaster, if the pylon was not to be cased with stone. The same technique was employed to form a batter on the faces of thick walls, except in rare instances in which the bricks were laid at right-angles to the slope of the face. Air passages are occasionally found in walls and pylons, examples being recorded from El-Amarna¹³ and Mirgissa.¹⁴

Construction in Undulating Courses of Brickwork.

Several theories have been advanced¹⁵ in an attempt to explain the purpose of walls built in alternate concave and convex panels of brickwork in place of horizontal courses. The majority of explanations have tried to discover a structural advantage in this mode of construction, related to the shrinkage or subsidence of the brickwork, but Barguet has suggested¹⁶ that the technique may have had a mythological origin. In support of the latter view it can be stated that walls of this type are found only around cultus-temples,¹⁷ and are not used in secular architecture.¹⁸ According to Barguet, the undulations of the enclosure-wall are a representation of the waters of the Nun, in the midst of which emerged the primaeval mound, upon which the first temple was built. Consequently, the temple surrounded by the wavy wall is, in effect, a model of the site of Creation. Many scholars dislike the explanation of architectural forms by means of theories based on Egyptian religion, and prefer to see everything in terms of structural necessity,¹⁹ but is not the whole purpose and meaning of an Egyptian temple based on mythology? The concept of the temple standing in the midst of the waters of the Nun is supported by textual evidence:



He made it, (Karnak) he created it, he baked it by the flame of his eye into land beside the water.²⁰

11. See above pp. 104-6.

12. Choisy, A., *L'Art de Batir chez les Egyptiens*, 16-7.

13. Pendlebury, J.D.S. *City of Akhenaten*, III, 92.

14. Dunham, D., *Second Cataract Forts*, II, 157 & Pl. LXXXIII A-B.

15. Choisy, A., *L'Art de Batir chez les Egyptiens*, 33-9; Chevrier, J., *RdE* 16 (1964), 11-7; Petrie, W.M.F., *Egyptian Architecture*, 10-2.

16. Barguet, P., *Le Temple D'Amon-Re à Karnak*, 32.

17. Excluding mortuary temples.

18. They occur in abbreviated form in houses of the first to fifth centuries A.D. in the Fayum.

19. See especially Chevrier, *op. cit.*, 16.

20. Drioton, E., *ASAE* 44 (1944), 114.



*The water and the earth were in it from the first. Sand came to establish a territory, to create ground. When it emerged, the land came into existence.*²¹

Considering the alternative theory, I set out below an examination of the arguments which have been advanced in favour of there being a structural purpose in the undulation of these walls.

Theory

1. The wavy form prevents cracks due to shrinkage since the contraction all occurs at the ends of the separate panels.²²
2. The technique prevents the formation of splits caused by the uneven rise and fall of the ground in the inundation.²³
3. Construction in panels prevents scaling of the face.²⁴
4. The wall cannot slip when built on a sloping site.²⁵

Objections

Cracks still occur (See Pl.48A) If so, why did the Egyptians not build all their walls this way?

Wavy walls are found on desert sites at Saqqara, Dime, & Deir el-Medina, and an example at Philae is founded on bedrock.

Not true (see Pls.48-9). Also the second objection to (1) applies.

These walls are found on level sites at Abydos, El-Kab and Philae.

In addition to the above, the existence of an undulating wall at Philae²⁶ with foundation courses of stone should be noted, since this clearly shows that the technique had nothing to do with any specific problems related to brick construction.

A number of different styles of undulating walls can be distinguished, varying in the complexity of their design. The most complete form which is best exemplified at Karnak, exhibits undulation of the brickwork not only along the face of the wall, but also through its thickness, in such a manner that the concave panels are *convex* in section, and *vice-versa*.²⁷ (Fig.75). A simplification of this type is produced when the convex sections of the wall are replaced by panels of brickwork built in ordinary horizontal courses, as shown in Fig.76 and Plates 48A, 50A. This simplification, which occurs frequently, was made purely for the sake of facilitating the process of construction, and has no chronological significance.

Fig. 75 Complete form of Undulating Wall.

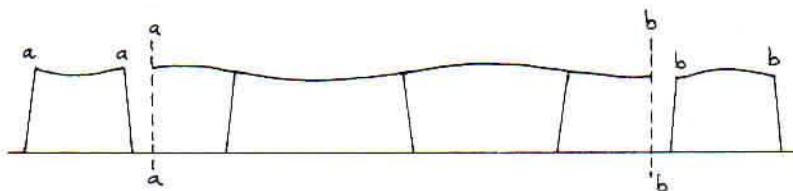
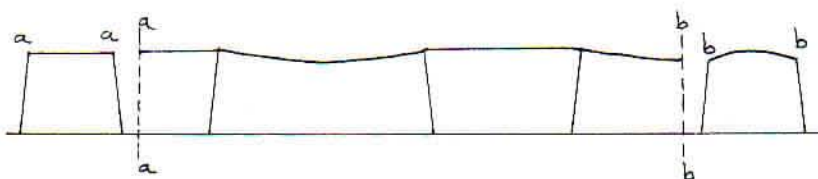


Fig. 76 Simplified form of wall with Horizontal Sections.



The enclosure wall of the temple of Edfu displays more severe abbreviation,²⁸ in which the alternation of concave and level beds is confined to the upper part of the wall, and the lower courses are laid horizontally, although the

21. *ibid.*, 114-5.

22. Choisy, A., *op. cit.*, 37-9.

23. *ibid.*, 33-4.

24. Petrie, W.M.F., *Egyptian Architecture*, 12.

25. Choisy, A., *op. cit.*, 34-7.

26. Choisy, A., *op. cit.*, Pls. I, 1-2; II, 1.

27. Chevrier, H., *ASAE* 52 (1952), Pl. VIII.

28. Choisy, A., *op. cit.*, 25.

Also Chassinat, E., *Edfou*, 14, Pl. DCLXX.

division of the brickwork into sections is still observed. The latter feature is found in all walls of the undulating type and it has been suggested that the concave sections were built first and allowed to dry before the convex or level panels were added.²⁹ This explanation is unlikely to be true, otherwise one would expect to find the same technique applied to brick constructions other than temple enclosure-walls. In fact, it is the undulation of the courses which imposes the formation of the separate panels; a glance at Figs. 75 and 76 will show that it prevents any interbonding of one panel with the next, in either the complete or the simplified form of the wall. In certain cases, however, some sort of bonding was achieved by the omission of the transverse curvature of the courses, but even so the appearance of a complete break between the sections was retained in order to conform to the standard pattern.

Sometimes the projecting angles of the concave beds of brickwork are revetted with blocks of stone. Evidence of this practice can be seen at Luxor, Dendera, El-Kab and Edfu,³⁰ and it may well have existed at many other sites originally. The purpose of the stonework was to protect the corners from damage, just as timber baulks were used at the corners of houses for the same reason.³¹ This kind of reinforcement was copied in the New Kingdom tombs at Thebes by setting burnt bricks into the corners of the walls, although these bricks were modified to fulfill a decorative rather than a structural purpose.³²

Well-built examples of undulating walls have air-passages from the face to the heart of the mass, connected with longitudinal passages in the interior, so as to form a complete system of ventilators which promoted rapid drying of the brickwork. It should be noted, however, that these air-channels are not restricted to walls of this type. They are usually the height of two bricks and the width of one, and they occur at regular intervals in the wall, as can be seen in Plates 49A and B.

With regard to bonding, these thick walls virtually always consist of a central mass of headers, whilst the outer faces exhibit alternate courses of headers and stretchers with carefully pointed joints. This is A2 or A3 bonding, although it is inevitable that irregularities occur in such large structures. Very few walls with undulating courses differ from this bond; the Roman temenos wall at Armant³³ is bonded A18, and some parts of the temple-enclosure at Elephantine³⁴ are A1. Brickbats are commonly used as closers at the ends of the separate panels of brickwork and around the air-channels (Pl.49B).

It is interesting to note that the Egyptians themselves considered all walls of this kind to be composed entirely of headers internally, as shown by some references in the Harris Papyrus to the construction of temple enclosures by Ramesses III. It is recorded that the king had a wall of twenty *ḏḏḏwt* built around the temple of Hermopolis,³⁵ *ḏḏḏwt* being, quite literally, the Egyptian word for headers. The word has, however, been translated as "courses"³⁶ of a wall, a totally misleading rendering, since it gives the impression of courses of bricks laid one over another, whereas the *ḏḏḏwt* are clearly stated to be "in the foundation, upon the ground."³⁷ Obviously then, the measurement refers to the thickness of the wall, and means that the foundation course was twenty brick-lengths across, that is some 8.40m.³⁸ This is a perfectly reasonable thickness for a temple enclosure-wall. The important point is that the Egyptians measured great brick walls in terms of headers, since these made up the bulk of the structure.

The use of timber ties and reed-matting, which is found in walls of the undulating type as well as in other brick constructions, is discussed in Chapter 13.

It is difficult to estimate the length of time which would have been required to build an enclosure wall of 10m or more in thickness, although it cannot have been very great, considering that Nectanebo I built such walls at Karnak, Luxor, Philae and possibly also at Hermopolis and numerous sites in the Delta. At Karnak, some parts of the ancient enclosure have been restored in modern times according to the original design, in undulating courses.³⁹ The reconstruction of the wall from the Tenth Pylon to the South-West angle of the enclosure, a distance equal to approximately one-tenth of the extent of the entire wall, occupied only a part of a single season's work. The ancient builders, with a larger labour force working for longer hours, could easily have completed the enclosure of Karnak in eighteen months, and may have only required one year, excluding the time needed for the manufacture of the bricks.

3. Brick Walls of Moderate Size.

This category includes the common general-purpose walls such as may be observed in all spheres of Egyptian architecture. Throughout the Dynastic period the usual form of bonding is Class A, but different systems occur later, as explained in Chapter 14. It is impossible to give a comprehensive account of the uses and structure of these walls; the main points only will be noted here, and the details will be found in the architectural survey which forms Part Two of this study. Generally speaking, the walls of ordinary houses are not as substantial as those found in the various forms of administrative or official buildings, in which wall thicknesses of between 1 and 2m are common.

29. Petrie, *Egyptian Architecture*, 12.

30. See above, pp. 74, 78, 81.

31. See below, p. 132.

32. See below, p. 140.

33. Mond, R., & Myers, O.H., *Temples of Armant*, 13.

34. Honroth, W., *ZAS* 46 (1909), 38, Abb.15.

35. *Papyrus Harris* I, 58, 5. cf. 57, 12 and 59, 2.

36. *Wb.*, V, 532.

37. *Papyrus Harris* I, 58, 5.

38. This measurement is based on bricks 42cm long, typical of monumental buildings at this date.

39. Chevrier, H., *ASAE* 49 (1949), 3-4 & Pl.IV.

However, walls of this size also occur in large mansions, such as those of Amarna, and in the late houses of Karanis and Dime. Some thick walls are found in the state-planned workers' villages, but these are the main divisions between different areas of the town, and are common to many houses. Apart from these special cases, most domestic brick walls are only 1.5 to 2.0 brick-lengths across, that is about 45-65cm. Thin walls are also found in many administrative and official buildings, but often they are of more solid construction, especially the exterior walls, which regularly attain a thickness approaching two metres. The palaces of Medinet Habu and the Ramesseum⁴⁰ have walls this size, but in the later palace of Apries at Memphis,⁴¹ where more emphasis was placed on security, the walls are commonly over 4m thick.

Certain town walls in Egypt were of quite modest dimensions and cannot have been intended to form strong defences. This is true of the Old- and New-Kingdom walls of Elephantine,⁴² which were between 1 and 2m across, and of the New Kingdom wall of Edfu,⁴³ which had a thickness of 1.95m. It is interesting to note that the only town wall of a clear defensive nature at this site belongs to the Graeco-Roman period.⁴⁴

All general purpose brick walls are constructed in horizontal courses, the system of alternate convex and concave sections being reserved for temple enclosures. One class of buildings forms an exception to this rule, namely certain houses of the first to fifth centuries A.D., mostly in town-sites of the Fayum,⁴⁵ although a few examples are reported at Elephantine.⁴⁶ In these houses the exterior walls are frequently built in concave courses of brickwork, but there is no particular alternation of separate panels, and no convex sections occur. The reason for the use of this technique in these buildings is in all probability due to mere imitation of a form which was considered to be traditionally Egyptian, the original purpose having been forgotten by this extremely late date. The fact that concave beds are employed here in secular buildings does not prove that there was a structural reason for this mode of construction, since the arguments set out above on this matter (page 115) are still valid, and furthermore, these houses are the only examples of secular buildings with walls of this type.

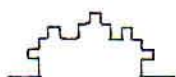
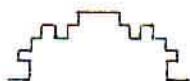
Another feature of the Graeco-Roman houses of the Fayum is the great quantity of timber reinforcement in the brickwork,⁴⁷ in contrast to the limited use of wood for this purpose in earlier domestic buildings. Details of the use of wood, reeds and plaster are given in Chapter 13.

Poor-quality construction is common in medium-thickness walls, in all kinds of buildings. In many cases, the heart of the wall is composed of haphazardly laid bricks, with the irregular gaps filled with mud or *tafl*, whilst the outer faces display a neat alternation of header and stretcher courses. Good examples of this careless manner of building occur in the Solar Temple of Userkaf at Abu Gurab,⁴⁸ and in the North-Western storehouse at the Ramesseum (see Pl.53A). Originally, of course, any deficiencies of the brickwork were hidden by a coat of whitened plaster, which was very seldom omitted from Egyptian brick constructions.

4. Palace-Facade Panelling.

The most widespread use of panelled walls occurs in buildings of the Archaic Period, especially the brick mastabas of the First Dynasty, but revivals of the same architectural device are found in later times, from the Old Kingdom to the Late Period. There are a number of different styles of panelling, of which the more complex forms are the earlier, whilst the later examples show considerable simplification. The layout of the large niche in buildings of various dates conform to the plans shown in the list below, where five different types are distinguished:

Form of Main Niche



Monuments

Naqada Tomb; Saqqara Tombs 2405, 3035, 3506; Tarkhan Mastaba 1060; Giza Mastaba T; Hierakonpolis Palace.

Saqqara Tombs 3357, 2185, 3471, 3503, 3504; Giza Mastaba V; Tarkhan Mastabas 2038, 2050.

40. Hölscher, U., *E.M.H.*, III, 50, 79.

41. Petrie, W.M.F., *The Palace of Apries*, Pl.I.

42. Jaritz, H., *MDIK* 26 (1970), 91-4.

43. Michałowski, K., *Tell Edfou*, III (1939), 104-6 & Plans II-III.

44. *ibid.*, Plans IV-V.

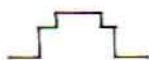
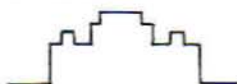
45. Boak, A.E.R., *Karanis*, 1924-8, 13, 46, & Pls. XVII, XXXIV, XXXVI.

46. Haeny, G., *MDIK* 26 (1970), 129-30.

47. See above, pages 99-100.

48. Rieke, H., *Das Sonnenheiligtum des Königs Userkaf*, I, Plan 6.

Form of main niche



Monuments

Saqqara Tombs 3038, 3111, 3505, 3507, 3036 (shallow niches); *Abu Roash* VII; *Helwan* 1374.H2.

Abydos: Shunet ez-Zebib and Middle Fort; *Giza*: Courtyards of the Funerary Temple and Valley Temple of Mycerinus.

South Saqqara: Court of Funerary Temple of Shepseskaf. (North wall only, other walls are type D.)

There is very little difference between types A and B, the plans being identical except for the alteration in the width of the central recess. Both these forms are used in the early part of the First Dynasty, and type A recurs in the revival of palace-facade in the Third Dynasty. The layout shown under C is found in buildings of the middle and late First Dynasty, and is a simplification of the earlier types, omitting the small niches in the sides of the outer recess. Further simplification takes place in D and E, in which the style of the main recess is reduced to a large compound niche.

Certain examples of palace facade are not included in the list since they are formed entirely of simple niches, without the deeper recesses described above. This simple panelling is found as early as the First Dynasty on the West side of Tomb 3505 at Saqqara,⁴⁹ and in small tombs in provincial cemeteries, such as 1514 at Naga ed-Der.⁵⁰ Later examples occur in the Funerary Palaces of Abydos, a number of Fourth Dynasty mastabas at Meydum, Third Dynasty mastabas at Reqaqnah and El-Kab, Old Kingdom tombs at Dendera and the mortuary temples of Mycerinus and Shepseskaf. Simple panelling also appears at a much later period in the great brick-built tombs of the Twenty-Sixth Dynasty at Thebes.⁵¹

The history of this type of architecture is, therefore, a process of gradual simplification, the most complex panelling occurring in the First Dynasty, with a transitory revival in the Third.

Despite the fine appearance of the palace facade of the First Dynasty mastabas, the arrangement of the brickwork of the niches is frequently quite irregular, the defects being hidden by the plaster coat on the surface. A typical example of the brickwork of a large niche is given in Plate XV of *Tarkhan II* by W.M.F. Petrie. Emery's diagrams of recessed panelling in the Saqqara mastabas,⁵² however, are full of inconsistencies, caused by an attempt to draw an ordered bond rather than admit the presence of irregularities.

Special bricks of very small size were used in some of the panelled mastabas of the archaic period in order to ease the process of niche construction. These are fully described in Chapter 15. The exterior coat of plaster, on which the fine appearance of the facade largely depended, was decorated in early times, but the later examples were left plain.

In the discussion of the metrology in Appendix I an attempt is made to discover the unit of measurement used in the construction of the palace-facade, since one would expect such a regular system to be laid out in standard proportions.

I have deliberately avoided any discussion of the origin of palace facade architecture in Egypt, since this topic has been dealt with elsewhere,⁵³ and does not belong in a structural study of this kind.

49. Emery, *Great Tombs of the First Dynasty*, III, 8 & Pl. 2.

50. Reisner, G.A., *Naga ed-Der*, I, 45 & Pl. 77.

51. Donadoni, S., *BSFE* 61 (June, 1971), 18-25 & Plan. Also Leclant, J., *Orientalia*, 41 (1972), Pls. XX-XXI.

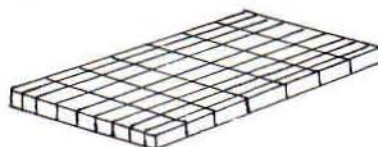
52. Emery, W.B., *Great Tombs of the First Dynasty*, II, 131-2.

53. Balcz, H., *MDIK* 1 (1930), 38-92. Wolf, W., *ZAS* 67 (1931), 129-131. Petrie, W.M.F., *Tarkhan*, II, 8-9.

CHAPTER TEN: FLOORS AND FOUNDATIONS

The simplest type of brick floor consists of a single layer of ordinary bricks laid in even rows upon the ground surface, as headers, with all the joints in line. (Fig. 77). Such floors occur at all periods in Ancient Egypt, in all classes of buildings. Less frequently, the bricks are laid on their edges, but the arrangement is still the same. As a general rule the brickwork is covered with a layer of mud plaster, over which there is usually a thinner wash of white gypsum.

Fig. 77 Floor of headers.



Another kind of floor is that formed of thin, square bricks, moulded specially for the purpose. These paving-slabs are almost exclusively found in administrative or official buildings, although they can occur in the mansions of the rich, such as the house of the Vizir Nakht at El-Amarna. Good examples of floors of this type have been recorded in the following buildings:

Location	Brick Size (cm)	See above, p
Palace of Seti II, Hermopolis.	40 x 40	84
Stores of Seti I, Abydos.	44 x 44 x 16	85
Police barracks, Amarna.	35 x 38.5	84
House of Nakht, Amarna.	—	94
Stores at Ramesseum.	40 x 40	86
Palaces & Admin. Buildings, Medinet Habu.	43 x 43 x 6	87
XXIIInd. Dyn. houses, Medinet Habu.	40 x 40 x 7	98
Admin. buildings & streets, Buhen, Shalfak & Mirgissa.	30 x 30 (Shalfak)	84
Temple of Amenhotep, son of Hapu, Western Thebes. ¹	40 x 34 x 9	

The large size of these bricks and their thinness shows that they must have been laid with considerable care, to avoid breakage. They were laid on a bed of sand and covered over with plaster. The paving tiles in the fortresses at Buhen, Mirgissa and Shalfak differ from the other examples given above in that they are formed of burnt brick in place of sun-dried mud, the reason for this being that they were employed to pave streets and unroofed rooms and were, therefore, exposed to the weather and to considerable wear.

Burnt bricks of ordinary proportions were frequently used in floors of the Roman period, but not exclusively so, since two instances of the use of this material at Medinet Habu date from the Twenty-First to Twenty-Second Dynasties.² The Roman burnt brick floors are usually formed in the traditional simple manner (Fig. 77) but occasionally a more complex "herringbone" pattern is found.³ (Fig. 78) Even at this late period, many floors were still constructed of mud-bricks in exactly the same way as in earlier times, although the advantages of burnt brick in resistance to water led to its use in all places subject to excessive damp, such as the public baths in Graeco-Roman towns.⁴

There are really only three types of brick floor to be distinguished: (1) a simple layer of headers, (2) square paving tiles, and (3) bricks laid in a "herringbone" pattern, but the first two alternatives can occur in either mud- or burnt-brick. The table below sets out the chronological distinction between the types on the basis of present evidence:

Arrangement.	Date.
<i>Mud brick:</i>	
Evenly-laid headers. ⁵	All periods.
Square tiles.	Dyn. XVIII, XIX, XXII.

1. Robichon, C. & Varille, A., *Amenhotep fils de Hapou*, 38 & PLIX.

2. Hölscher, U., *E.M.H.*, V, 5, 8.

3. Badawy, A., *ASAE* 46 (1947), 367.

4. See above, pp. 91-2.

5. These headers may be laid flat or on their edges, the former being more common.

Arrangement.

Date.

Burnt brick:

Evenly-laid headers.

Bricks in "herringbone" pattern.

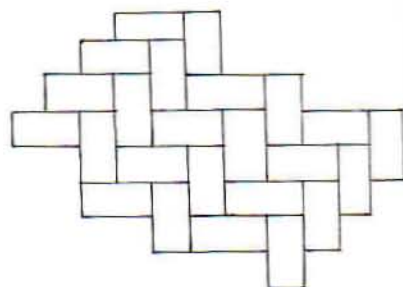
Square tiles.

Dyn. XXI, XXII and Graeco-Roman.

Roman.

Middle Kingdom.

Fig. 78 Floor of bricks laid in "herringbone" pattern.



In the majority of Egyptian architecture, very little attention was given to the preparation of good foundations, neither in masonry nor in brickwork. Small brick walls were most frequently built directly on the ground surface, which received no preparation other than levelling. Walls of more massive dimensions, including the great enclosures of the temples, were provided with only slightly better foundations, consisting of a bed of sand in a shallow trench. In some cases, an apparent foundation was created by raising the level of the floor within the building, and thereby burying the lowest courses of the walls. This technique was used in the mortuary temple of Mycerinus at Giza, where the levelling of the floor with rubble has buried the walls to a depth of between one and seven courses.⁶ Usually the foundation layer of bricks in walls of Pharaonic age consists of headers on edge, or, less frequently, of ordinary headers.

Occasionally, the solidity was improved by the use of stone for the lower courses of the walls, as occurs in some of the houses in the workers' village at Deir el-Medina,⁷ but as this stonework is above ground it cannot be classed as a true foundation. This is also true of the stone courses which formed the base of the temple-enclosure wall at Philae.⁸ Granite rubble was used as a foundation for the walls of the Nubian fortresses,⁹ wherever the brickwork did not rest directly on the bedrock; this would prevent any attempt to mine the walls. In late times burnt brick could be used for foundations; it occurs in the lower courses of a Roman wall in the temple of Mut at Karnak,¹⁰ and in the foundations of Coptic houses at Medinet Habu.¹¹

Mud brick was regularly employed to construct foundations for the columns of stone buildings, the base of each column resting on an individual pier of brickwork. These piers are usually square, as in the palaces of Ramesses III and Ay at Medinet Habu,¹² but circular examples have been discovered at Malgata, North-West of Karnak.¹³ Their size is naturally adjusted to suit the diameter of the column bases which they support, the brick foundation being rather wider than the base.

More elaborate examples of brick foundations beneath stone buildings are found in the cellular platforms which were built to support small peripteral temples. These platforms are composed of a mass of brickwork containing gravel-filled compartments, so as to create an elevated podium, which was, in a number of cases, approached by means of a ramp. A number of foundation-platforms of this kind have been excavated in Egypt, but their true nature has not always been recognised, and they have been mistaken for storehouses¹⁴ or left unexplained, although Petrie correctly identified one example at Hu as long ago as 1901.¹⁵ During recent excavations at Saqqara,¹⁶ in which several foundations of this type were discovered, their purpose has been further clarified, since fragments of inscribed limestone were found in the filling of the compartments in the brickwork, probably from the stone chapel which the structure supported. Final proof of the nature of these brick platforms is found at Karnak and El-Kab, where the remains of a small peripteral chapel still stand upon a foundation of cellular brickwork.¹⁷ Only eight examples of this type of foundation are known to me,¹⁸ at the following sites.

6. Reisner, *Mycerinus*, 91.7. Bruyère, B., *Deir el-Medineh*, 1934-5, 28.8. Choisy, A., *L'Art de Bâtir chez les Egyptiens*, Pls. I-II, 1.9. Dunham, D., *Second Cataract Forts*, I, 5, 114; II, 21.

10. See p. 80.

11. Hölscher, U., *E.M.H.*, V, 45.12. *ibid.*, vol. II, 81: III, 45.13. Chevrier, H., *ASAE* 46 (1947), 157 & Pl. XLVII.14. Bisson de la Roque, F., *Medamoud*, 1927, 7-12 & Pl. I.15. Petrie, W.M.F., *Diospolis Parva*, 55-6 & Pl. XXIV.16. Martin, G.T., *JEA* 59 (1973), 5-15, especially p. 11 & Fig. 1.17. Varille, A., *Karnak*, I, 33. Capart, J., *Fouilles de El-Kab - Documents*.18. Another possible example is the structure at Tell el-Maskhuta, called "chambers" by Naville in *The Store-City of Pithom*.

Tanis	see above, p. 71
Saqqara (3 examples)	72
Hu (Diospolis)	79
Medamud	79
Karnak, Montu temple-area. ¹⁹	
El-Kab	75

The brickwork of these structures is in each case well-laid, and there is no communication between the compartments within it. At Tanis, Medamud, Karnak and El-Kab there were ramps to the top of the platform to give access to the chapel. At Saqqara, the buildings stand on a sloping site, and it has been stated²⁰ that this necessitated the preparation of elaborate foundations, but this does not explain the presence of similar structures on sites where the ground is level. The real intention of the brick platform was to elevate the building which stood upon it, as Egyptian peripteral temples were usually raised above the ground and approached by ramps.

Cellular platforms of brick, of a slightly different kind from those discussed above, were used as foundations for military camps at Deffeneh, Naukratis and Memphis. Here again the foundation was used to elevate the building, so that the living quarters, raised several metres above the ground, would be more defensible. The lower part of the structure consisted of a block of brickwork, with internal compartments, some of which were gravel-filled, whilst others in contrast to the foundations of peripteral chapels, which were always filled up solid, were domed over and used as store-cellars. A structural description of these military camps has already been given in Chapter 8 (pp.106-7). It should be noted that all the examples of cellular platforms so far known belong to Late-Period or Graeco-Roman times.

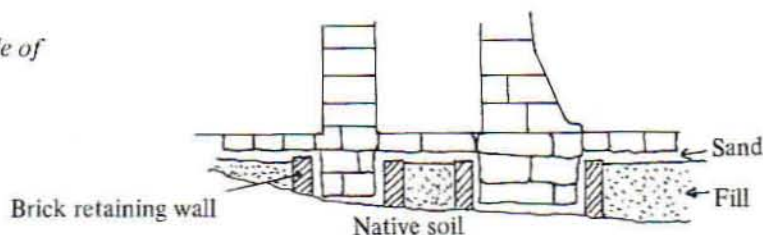
Extensive use was made of brick in the foundations of temples from Saite times onwards to build a retaining-wall around the sand bed upon which the temple stood. The preparation of the site was carried out as follows: first, a great rectangular pit was excavated and its sides were lined with a thick wall of mud-brick; the enclosed space was then filled up with sand, over which were placed several courses of stone blocks, to form a platform for the temple. Several foundations of this kind have been found by excavation, especially in the Delta, where the destruction of the temples has left their substructures exposed. A particularly good example has recently been discovered at Mendes,²¹ with a buttressed brick lining-wall around the foundation sand, but the technique was not restricted to the Delta, since it occurs at the temple of Deir el-Medina at Thebes.²² Other examples have been found at Gemaiyemi, Nebesheh and Tukh el-Qaramus (pp.72 and 77). The following text, from the temple of Edfu, would seem to indicate that this method of founding a temple was the standard rule in Late times:



"He excavated its foundation as far as the water, it being filled up with sand according to the rule, being constructed of sandstone as an excellent work for eternity."²³

The temples of earlier periods do not have this deep substructure, and brickwork was not normally employed in their foundations. A small amount of brick was used beneath the temple of Ramesses III at Medinet Habu for the purpose of lining the wall trenches to prevent the collapse of their sides prior to the laying of the stone blocks of the foundation.²⁴ (Fig.79)

Fig. 79 Foundations in the Temple of Medinet Habu.



An exceptionally solid mass of brickwork was found to underlie the pavement of the North gate of the precincts of Amun at Karnak, going down to a depth of eleven courses below the floor.²⁵ Most of these bricks were laid

19. Varille, *op. cit.*, 33.

20. Martin, G.T., *JEA* 59 (1973), 11.

21. Hansen, D.P., *JARCE* 6 (1967), 6-7 & Pls. II, IX, 7.

22. Bruyère, B., *Deir el-Medineh*, 1935-40, fasc. I, 44, 52.

23. Chassinat, E., *Edfu*, I, 23, 4-5.

24. Hölscher, U., *E.M.H.*, IV, 31.

25. Christophe, L., *Karnak-Nord*, III, 12-3 & Pls. XXXI - XXXVI.

parallel to the axis of the gateway, as headers or on their edges, but irregularities were common and some courses consisted only of a layer of broken bricks.²⁶

In conclusion, it may be stated once more that the majority of Ancient Egyptian buildings had inadequate foundations. It is important to note that those foundations which are solidly constructed, such as occur beneath the temples and fortified camps of the Late Period, were not the result of a desire to create a firm base for the building, but were really motivated by mythological or military considerations.

26. *ibid.*, Pls. XXXII - XXXIV.

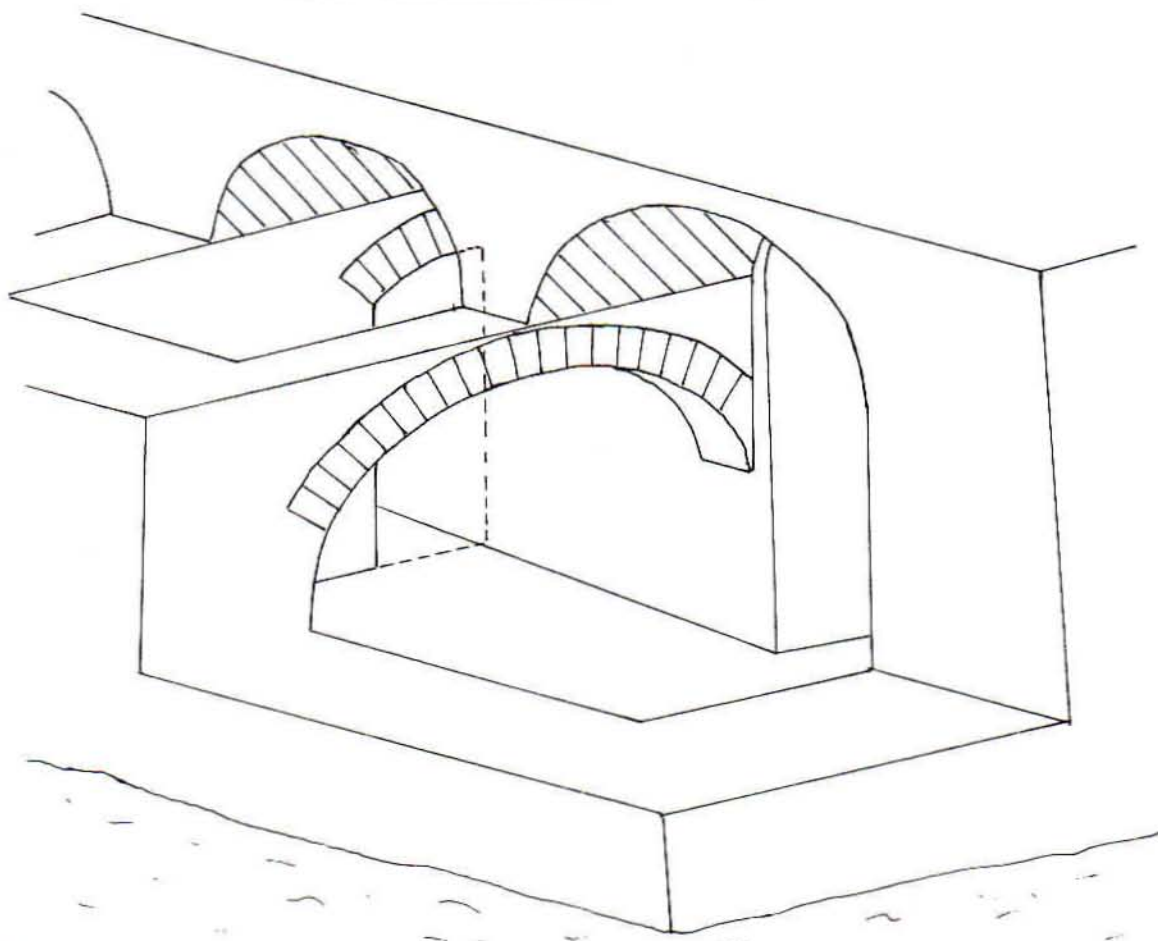
CHAPTER ELEVEN: ARCHES, VAULTS, DOMES AND CORBELS

Arches and Vaults:

The earliest examples of the use of brick vaults in Egypt occur in the subsidiary graves of tomb 3500 at Saqqara, (page 10) in which the substructures are roofed by vaulting of type d1. Further examples of this kind of vault are known from the Archaic Period in tombs at Beit Khallaf (page 23) and Reqaqnah (page 23) and many d1 vaults occur in the funerary architecture of the Old Kingdom. This type of vaulting must be one of the longest-lived architectural forms ever devised, since it was in common use from the First Dynasty down to the Coptic period. True arches seem to have come into use later than the inclined vault; the earliest well-attested examples are found in tombs of the Third Dynasty at Beit Khallaf, Reqaqnah and Saqqara, and the bonding in all these cases is type c1 (pages 23-4). There is a faint possibility that an arch may have been employed in tomb T.23 at Naqada, but the only evidence for this rests on a brief note in Petrie's field records, and it would be rash to infer that the arch was known in Predynastic times.¹

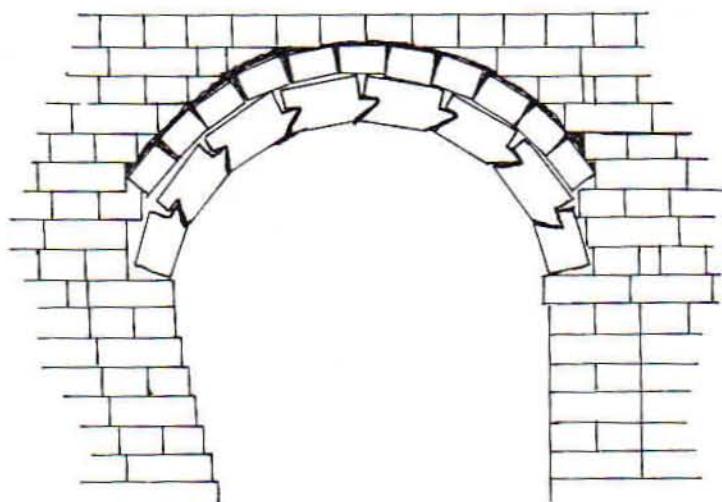
The use of both arches and vaults increased greatly after the close of the Archaic Period, becoming widespread in the tombs of the Old Kingdom. Arches in the form of an arc of a circle occur for the first time at Giza,² where they are used to form a support for the springing of two parallel vaults (Fig.80). Such arches are of type c1, but they are composed of specially shaped bricks which produce parallel ribs along the soffit of the arch, in imitation of earlier building materials. In the tomb of Sabef³ there was an unusual vault over the chapel, formed of interlocking bricks assembled in d1 bonding, as shown in Fig.81. All the different forms of bricks used in these tombs are described in Chapter 15.

Fig.80 Vaults sprung from arch in Tomb of Irti at Giza.



1. Kemp, B.J., *JEA* 59 (1973), 41-2 & Fig.2.
2. Junker, H., *Giza*, V, 156-9; IX, 142-3. Badawy, A., in Abu-Bakr, A.M., *Excavations at Giza*, 1949-50, 129-31.
3. Fisher, C., *The Minor Cemetery at Giza*, 114-9 & Pls. 17-9.

Fig. 81 Vault of special bricks in the Tomb of Sabef at Giza.



Later in the Old Kingdom there was a tendency to construct thick arches and vaults in both the substructure and superstructure of large mastabas, examples being recorded at Saqqara, Dara, Dendera and elsewhere. These vaults are sometimes built in cx1 or cd1 bonding, although the simple c1 and d1 remain the most common. Details of the chronology of the different bonds are reserved for Chapter 14.

Large relieving arches are found in the royal pyramids of the Middle Kingdom, and in some of the large private tombs of the same period.⁴ In many cemeteries, brick vaults were used independently to roof the burial chambers, as at Qattah and Edfu.⁵ Small graves very frequently have an arched covering for the substructure, not only in the Middle Kingdom, but at all periods from the Old Kingdom to Roman times. These burial vaults are usually built in c1, d1 or x1 bonding, and show little variation from one site to another, although some of the later examples are constructed of burnt brick.

Despite the popularity of rock-cut tombs in the New Kingdom brick vaults were still in common use, especially in the cemeteries of Deir el-Medina and Dira abu'l Naga.⁶ It is in the New Kingdom, also, when we find more evidence of vaulting in other fields of architecture, such as administrative buildings, palaces and small chapels, although it does not become common in domestic buildings until the Ramesside period. The small number of examples of vaulting from non-funerary architecture prior to the New Kingdom does not necessarily mean that none existed, since it is probably due to the poor state of preservation of these early monuments. That the vault was in use in these buildings is shown by the vaulted roofing of the Causeway at the Mastabat el-Fara'un,⁷ and the vaulted chapel at the South Pyramid of Mazghuneh.⁸ Vaults were also employed, to a limited extent, in domestic buildings of the Middle Kingdom at Kahun.⁹

From the later New Kingdom onwards the use of brick arches and vaults greatly increased in all types of buildings. The tombs of the Late-Period at Abydos have large vaulted chambers, sometimes with multiple vaults set one over the other.¹⁰ Great arches occur in the Saite tombs at Thebes, built in cd1 or cx2 bonding, and several courses in thickness (Pl. 47B). Vaulted roofing becomes common in domestic architecture in the late Dynastic period, and is even more widespread in Graeco-Roman and Coptic times, as exemplified by the houses at Karanis, Dime, Medinet Habu and Edfu.¹¹

Practically all the arches and vaults in Egyptian buildings are semicircular or catenary vaults. Pointed arches are rare before the Byzantine period, the only known examples from dynastic times being found at Esna and Edfu (pp. 37 and 48). Instances of the construction of arches of a very flat curve are more common; they are employed in Old Kingdom mastabas at Giza, a tomb of the New Kingdom at Thebes,¹² and at the temple of Deir el-Medina, although this last example is really a vault (Pl. 52A).

4. Quibell, J.E., *Excavations at Saqqara*, 1905-6, 26-7 & Pl. XXI.

5. See above, pp. 40 & 41.

6. See above, pp. 46-47 & Pl. 46B.

7. Jéquier, G., *Le Mastabat Faraoun*, 20 & Pl. X, 2.

8. Petrie, W.M.F. & Mackay, E., *The Labyrinth, Gerzeh & Mazghuneh*, 48.

9. Petrie, W.M.F., *Kahun, Gurob and Hawara*, 23.

10. Garstang, J., *El Arabah*, 21 & Pl. XXXV.

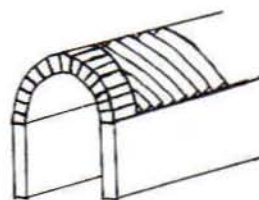
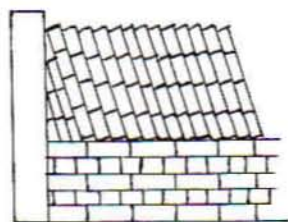
11. See above, pp. 99-101.

12. Northampton, *Excavations in the Theban Necropolis*, 14-5 & Pl. XIV.

Thin bricks were normally employed for vaults of types d1 and x1, and by the New Kingdom they were made with one side slightly longer than the other, so as to achieve the necessary wedge-form.¹³ The bond d2 also required thin bricks, but these had a greater breadth than usual, becoming almost square in shape, whilst broad, curved bricks were used for the vault e1. However, curved or wedge-shaped bricks occur far less frequently than the ordinary rectangular form, and consequently most Egyptian arches exhibit wide gaps between the bricks on the outside of the curve, these spaces being filled up with stones or potsherds.

It is not true to say that the Egyptians did not use any kind of temporary centring in the construction of arches and vaults. Only the d1 and d2 forms of vault could be built without centring, since the inclination of the bricks from the vertical caused a large proportion of the weight of each brick to rest upon the previous course, rather than act downwards. Consequently the bricks would be held in place by the cohesion of the mud mortar long enough for each course to be completed. In order to build a vault of this type, it would be necessary to provide something for the inclined rings of brickwork to rest upon at the end of the vault. It seems most likely that a rough wall would have been built for this purpose, which could have been easily removed on completion of the vaulting.¹⁴ (Fig.82). In the case of a vault intended to roof an internal room or a cellar the problem does not arise, since the courses of bricks would rest on the walls of the room, as shown in Plates 55A - B. Many vaulted passages make use of a different system, in which an arch is used to support the inclined vault.¹⁵ The arch is frequently built in c1 bonding, which would require centring, but it enables the whole of the long d1 vault to be constructed without temporary support (Fig.83). Good examples of this method of building are found in the entrance tunnel of the Osireion at Abydos,¹⁶ and in the tomb of Adu at Dendera,¹⁷ but many others could be quoted.

Fig.82 Inclined Vault built against supporting wall. Fig.83 Inclined Vault built against arch.



The fact that the inclined type of vault could be built without recourse to temporary centring led to its use in the arrangements bd1 and cd1, in which the upper rings of headers were supported during construction by the leaning courses below (Pl.19). There are certain cases where it seems likely that even the d1 type of vault had temporary centring, due to the large span to be covered, or to the adoption of a fairly low curve for the vault. For this reason, it would have been impossible to build the roof of the Mammisi at Deir el-Medina without support for the bricks,¹⁸ and the same applies to the vaulting in the mortuary temple of Amenhotep, son of Hapu, where the span was 7.70 m.¹⁹ It is certain that a centring of wooden beams was employed in the entrance hall of the temple of Beit el-Wali,²⁰ and in the palace of Ramesses III at Medinet Habu,²¹ because the marks of the beams still show where they were let into the walls, but the form of the vaulting used in these buildings is not certain. However, the 6 m span of the vault at Beit el-Wali, together with its profile, (the outline can still be seen on the rear wall) suggest that it was of the inclined form, this being the type of vault most commonly used over wide spans in Dynastic times. The largest span known occurs in the Royal Stables at Medinet Habu²² (8.60m) and another vault of only slightly less size was used in the temple of Amenhotep, son of Hapu, mentioned above.

In all the types of arches and vaults in which leaning courses were not employed centring was an absolute necessity. For small arches, such as are common over doorways, this support could quite easily have been made of wood, but for large arched tunnels and gateways it was more economical to use earth centring. Evidence of this process is found at El-Kab, where an arched gateway in the enclosure wall is still blocked by the earth centring placed there at the time of its construction.²³ Probably this technique was extremely common, especially in domestic and funerary architecture. Petrie believed it to have been used in houses at Illahun,²⁴ and it may also have served for the construction of the great arched tunnel in Mastaba M at Dara.²⁵

13. Bruyère, B., *Deir el-Medineh*, 1934-5, 25, fig.1.

(The curvature of these bricks is never as great as shown).

14. See Choisy, A., *L'Art de Bâtir chez les Egyptiens*, 42.

15. *ibid.*, 48.

16. Frankfort, H., *Cenotaph of Seti I*, 13-4.

17. Petrie, W.M.F., *Denderah*, 8-9 and frontispiece.

For details of inclined vaults see Fathy, H., *Gourna: A Tale of Two Villages*, 16-8 & Pls. 7-18.

18. See Plate 52A.

19. Robichon, C. & Varille, A., *Amenhotep fils de Hapou*, 38 & Pl.XI.

20. Ricke, H., Wente, E.F. & Hughes, G.R., *Beit el-Wali*, I, 2, Pl.18.

21. Hölscher, U., *E.M.H.*, III, Pl.26; IV, 29.

22. *ibid.*, IV, 18.

23. Somers Clarke, *JEA* 7 (1921), 69.

24. Petrie, W.M.F., *Kahun, Gurob and Hawara*, 23.

25. Weill, R., *et al.*, *Dara*, 119.

Most Egyptian vaults were sprung from ordinary brickwork, and it is only in Roman times that burnt bricks were used as a springing for mud-brick vaults,²⁶ on account of their greater hardness. When the vault rested on a stone wall, or on stone architraves, there was usually a ledge cut to receive it, as in the storehouses of the funerary temple of Merenptah.²⁷

Domes

Domes are not common in Egyptian architecture until Coptic times, but examples do occur from the Old Kingdom onwards. At Giza, the mastabas of Seneb and Neferi²⁸ had chambers with domed roofing, formed of courses of stretchers tilted inwards by placing chips of stone under the outer edge of the bricks. Similar domes occur in the tomb of Merra at Dendera²⁹ and in a tomb of the Fifth Dynasty at Abydos.³⁰ There is considerable distortion in the form of these domes when they are used over square rooms, as at Giza, since pendentives were not built. Domes have also been found over the shafts of Twelfth Dynasty tombs at Riqqeh,³¹ but their construction has not been recorded in detail. A more interesting dome occurs in a tomb of the New Kingdom at Thebes, because it is the only known example from dynastic architecture to make use of pendentives at the corners of the chamber. The constructional details of this dome have already been described. (pp.47-8). Difficulties were encountered in the use of the pendentives and the innovation was not repeated in other buildings.

The few examples of domes which are known from the Late Period all occur in the fortified camp which Psammetichus I built at Deffeneh, and they were apparently constructed in courses of stretchers.³² The domes were used to cover some of the compartments in the foundation of the building, and it is possible that other domes may have existed for this purpose in the similar military camps at Naukratis³³ and Memphis.³⁴

Better construction is found in the domes of Roman age, which are sometimes formed of burnt brick, as in certain recently discovered buildings at Alexandria.³⁵ More simple domes occur in the Roman tombs which were built over the site of the mortuary temple of Ay, at Medinet Habu.³⁶ The development of the use of domed roofing in Coptic times can be seen in the buildings of that age at Bawit³⁷ and Kharga,³⁸ where pendentives were regularly employed. These late examples would have required centring during construction, but probably the small domes used in the Dynastic period could have been built without centring. Ignorance of the pendentive seems to have been the main reason why so little use was made of domes in early times, because it led to great difficulties in adapting a circular roof to suit a square room, problems which did not arise in connection with the more popular barrel-vault.

Corbels

The process of corbelling, in which a chamber is roofed by gradually overlapping the bricks of the walls until they meet, is encountered in various uses in Egyptian architecture. The most frequent use occurs in tombs, in which the corbel is employed to roof the burial chamber. Such tombs are found in cemeteries of the Second Dynasty and of the Old Kingdom, but the earlier examples are distinguished by having a stairway entrance to the substructure, whereas the later type are without entrance.³⁹ Both types existed at Naga ed-Der, and more Old Kingdom examples have been found at Tura and Reqaqnah. In some cases the corbels of the Fifth Dynasty are circular, in order to imitate the form of burial under an inverted pot, but the Archaic corbels, at least at Naga ed-Der, have groined corners. (Details of these tombs are given on pages 12-13, 26 and 29-31.

Corbelling occurs less frequently in other uses. At Beit Khallaf the descending passage in mastaba K.5 was covered by a corbel-vault,⁴⁰ although no details of its construction are recorded. Granaries were often closed in towards the top by corbelling the brickwork, in a manner which continues more or less unchanged throughout Egyptian history. The earliest example of this usage occurs in granaries attached to Tomb 3038 at Saqqara,⁴¹ and the same technique is found in granaries in the Graeco-Roman town at Edfu.⁴² During the New Kingdom, corbels were employed in the

26. Mond, R. & Myers, O.H., *The Bucheum*, I, 29.

27. Petrie, W.M.F., *Six Temples at Thebes*, 12.

28. Junker, H., *Giza*, V, 30ff. & fig.3 on p.25.

29. Abu Bakr, A.M., *Excavations at Giza*, 1949-50, 139.

30. Petrie, W.M.F., *Denderah*, 15-6.

31. Frankfort, H., *JEA* 16 (1930), 216.

32. Engelbach, R., *Riqqeh and Memphis V*, 7.

33. Petrie, W.M.F., *Tanis*, II, *Nebesheh & Deffeneh*, 53.

34. Petrie, W.M.F., *Naukratis*, I, 24-6 & Pls. XLII-XLIII.

35. Petrie, W.M.F., *The Palace of Apries*, I.

36. Kubiak, W.B. & Makowiecka, E., *ASAE* 61 (1973), 117.

37. Hölscher, U., *E.M.H.*, V, 42 & Pl.28F.

38. Maspero, J., *Fouilles exécutées à Baouit*, 45.

39. Fakhry, A., *El-Bagawat in Kharga Oasis*, *passim*.

40. Reisner, G.A., *Naga ed-Der*, III, 6-10.

41. Garstang, J., *Maharna and Bet Khallaf*, 15.

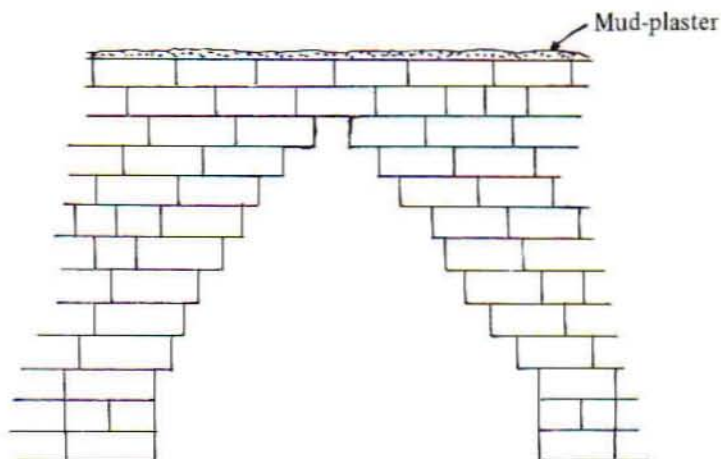
42. Emery, W.B., *Great Tombs of the First Dynasty*, I, 85.

43. Michalowski, K. et al., *Tell Edfou*, II (1938), 94-5.

brick pyramidal tombs of Thebes⁴³ and Aneiba,⁴⁴ since the pyramids themselves were hollow and the brickwork had to be made to meet at the apex. Exactly the same process was used at a later date in the small pyramid which stands beside the tomb of Montuemhat at Thebes.⁴⁵

Despite the widespread use of corbelling, the technique of construction varies little with date or location. Corbels are virtually always formed of headers, because this way the bricks can be overlapped a fair distance without risk of them falling. Exceptions to this rule occur in the tombs at Naga ed-Der, where some of the corbels have alternate layers of headers and stretchers on the internal surfaces,⁴⁶ but the mass of brickwork behind the face is still composed mainly of headers. The majority of corbels have a great amount of brickwork used as a cantilever to prevent collapse of the overhanging bricks, (Fig.84) but in circular granaries this is not necessary, since the face that the bricks are laid in a circle prevents any collapse. Usually a great quantity of mud is plastered over the brickwork of corbelled structures to give increased rigidity.

Fig.84 A Typical Corbel.



43. Bruyère, B., *Deir el-Medineh*, 1922-3, Pl.XX.

44. Steindorff, G., *Aniba*, II, Pl.42.

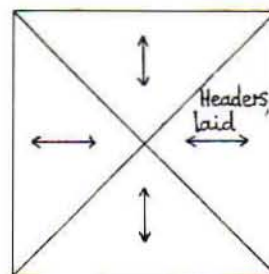
45. See above, p. 52.

46. See above, pp. 12-13.

CHAPTER TWELVE: SOLID BRICK CONSTRUCTION IN MASTABAS AND PYRAMIDS

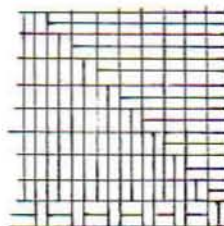
Mastabas and pyramids of solid brickwork were constructed in similar fashion, the bricks being laid as headers from each face to the centre, thereby forming a joint along the line of the diagonals through the structure. (Fig.85). The bricks were stepped backwards at each course in order to produce the desired slope on the outer face, and consequently they break joint with the courses above and below, but not within each individual layer of the brickwork.

Fig.85 Layout of Brickwork in a Brick Pyramid.



In some cases the face of the structure exhibits alternate courses of headers and stretchers, but this arrangement persists only to a depth of one or two bricks, after which headers alone occur.¹ In the royal pyramids of the Middle Kingdom, the bricks are usually laid in sand with no attempt at mortaring. The brickwork immediately above the burial chamber, however, could sometimes be laid with mud mortar, as occurs in the pyramid of Hawara.² Where relieving arches were incorporated into the pyramids, at Hawara³ and South Saqqara,⁴ the bricks of the arch were bonded with mortar.

Fig.86 Bonding at corner of the Pyramid of Hawara.



Certain pyramids have cross-walls of stone running through their structure, dividing the brickwork into separate masses, but the bonding pattern is largely unaltered. The bricks of the Middle Kingdom royal pyramids are always very large, averaging about 42cm in length.

Solid brick mastabas, especially those of great size, are often built of headers in the same manner as the pyramids, but the bricks are laid in mud or *tafl* mortar in place of sand. There are exceptions, of course, to this method of construction, and many small mastabas are built in A1, A2 or A3 bonding.⁵ However, examples of this technique are found in the great mastabas of the Third Dynasty at Beit Khallaf,⁶ and in the enormous Sixth Dynasty tombs at Dara.⁷ In tomb K.1 at Beit Khallaf the brickwork was laid in sections from the outer faces towards the centre. The diagonal joint formed at the angles of structures built entirely of headers laid in this way also occurs in the thick casing-walls of the common rubble-filled mastabas of the Archaic Period, including some of the palace-facade tombs of the First Dynasty.⁸

The small brick pyramids which stand above the tombs of the New Kingdom at Deir el-Medina are not always built of headers, but other bonds occur. This is probably due to the fact that the pyramids were hollow, since they contained a vaulted chapel, and consequently their exterior walls are fairly thin. In similar tombs at Aneiba⁹ the brickwork of the pyramids was bonded A1. However, construction in courses of headers does occur in small pyramids at Dira abu'l Naga¹⁰ and at Soleb in Nubia¹¹ (Fig.87).

This method of building was probably employed for its simplicity, which would have been an advantage in the rapid construction of the great masses of brickwork necessary for pyramids or large mastabas. The technique is related to the Egyptian habit of using courses of headers for the internal structure of very thick walls, also for the sake of simplification of the building process.

1. L.D.T. II, 27.

2. Petrie, W.M.F., *Kahun, Gurob and Hawara*, Pl.IV.

3. *ibid.*, 16 & Pl.IV.

4. Jéquier, G., *Deux Pyramides du Moyen Empire*, 34 & Pl.VII (a).

5. See examples on pp. 24-5 and 33-4.

6. See above, p. 22.

7. See above, p. 29. Weill, R & Pillet, M., *Dara*, Pls. XXX-XXXI.

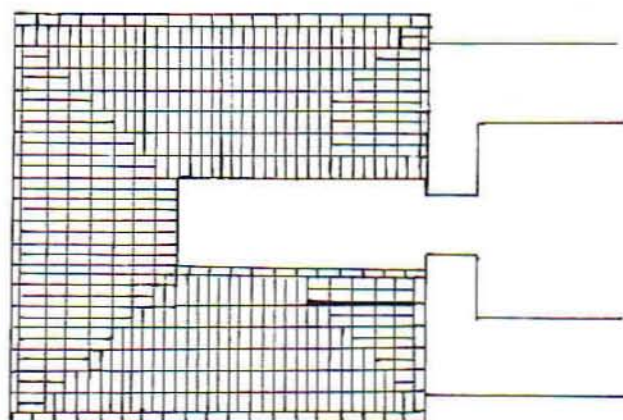
8. See above, pp. 16, 19 and 22.

9. Steindorff, G. et al., *Aniba*, II, Pls. 25, 38 & 41.

10. See above, p. 47.

11. Giorgini, M.S., *Soleb*, II, 112, 185, 230, 243.

Fig. 87 Plan of the Brickwork in a Pyramid at Soleb.



CHAPTER THIRTEEN: SUPPLEMENTARY MATERIALS IN BRICK CONSTRUCTION

A number of supplementary materials, such as wood and stone, occur regularly in Egyptian brick buildings. The purpose of this section is to give some account of the uses of these materials, without going into details, except to describe how their use affects the brickwork.

Wood.

Probably the most important use of wood in Egyptian brick architecture was the construction of roofing, which was usually formed of planks supported on beams. Roofs of this kind first occur on a small scale in tombs of late Predynastic date,¹ but much larger examples were used in the great First-Dynasty tombs of Abydos and Saqqara. In some of the Saqqara tombs, where the area to be roofed was very large, the ordinary rafters were supported from below by massive beams of rectangular section,² whilst at Abydos the roofing was sometimes upheld by wooden posts.³ The wooden roof could be protected by covering it with brickwork, as in tomb 3505 at Saqqara,⁴ and in many of the small graves of the First Dynasty.⁵ This technique also occurs at a later date in the Funerary Temple of Mycerinus at Giza.⁶ A slightly different type of roof was used in tomb 3036 at Saqqara, in which the bricks rested directly upon closely-set logs, below which was a ceiling of wooden planks.⁷ This is a similar method to that used in grave 1647 at Naga ed-Der,⁸ and in houses of a very late period at Theadelphia.⁹ Small rooms and passages in buildings of all ages were commonly roofed with split palm-logs, a form of roofing copied in stone at the Step Pyramid.

The development of the rock-cut burial chamber at the end of the First Dynasty led to the abandonment of wooden roofing in funerary architecture, except for small-scale uses such as the roofing of offering niches. In all other kinds of brick buildings, however, wood continued to be employed for this purpose down to very late times, despite the increasing use of vaults. Wooden planks were not usually employed above the rafters in domestic architecture. Instead, layers of sticks and reeds were used, consolidated with a coating of mud. In rich houses at El-Amarna, the rafters were not left as rough logs, but were covered with the decorated plaster which was applied to all the interior of the roof.¹⁰ When the size of the room was very great, there was a main beam across the centre, supported on wooden columns, with smaller rafters running from this beam to each end of the room.¹¹ A different kind of roofing, used in the palace of Amenhotep III at Malkata, has already been described on page 87.

From the Twentieth Dynasty, brick vaults become fairly common in domestic buildings, and they tend to replace wood for the roofing of narrow passages or small rooms, especially cellars. However, wood was still a major constructional material right down to Graeco-Roman times, and the remains of roofs made of palm logs have been found in houses of the Third and Fourth Centuries A.D. in the Fayum.¹² The restriction of vaulting to the cellars and ground-floor rooms may have been due to the use of earth centring, since it would not have been practicable to fill the rooms on the third or fourth storey with earth, in order to provide centring for a vaulted roof.

Wooden columns were an essential accessory to the use of timber for roofing, and they occur frequently wherever large areas had to be roofed. Such columns were used in the mortuary temples of Mycerinus¹³ and Neferirkare,¹⁴ as a less costly substitute for stone, but the majority of examples occur in secular buildings. In the rich mansions of Amarna, the columns were well-formed and they stood on stone bases,¹⁵ whilst in poor houses a column could be formed of a rough post.¹⁶ Several of the official buildings at Amarna had brick piers¹⁷ to support the roof instead of wooden columns, presumably to save valuable timber.

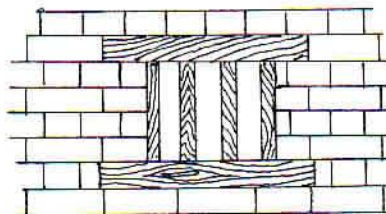
1. Quibell, J.E. & Green, F.W., *Hierakonpolis*, II, 20.
2. Emery, W.B., *Archaic Egypt*, 184, 186, Fig. 107.
3. Petrie, W.M.F., *Royal Tombs*, I, 8-16 & Pls. LXV, LXVII.
4. Emery, W.B., *The Tomb of Hemaka*, 4-5.
5. See above, p. 10.
6. Reisner, G.A., *Mycerinus*, 91-3 & fig. 20.
7. Emery, W.B., *Great Tombs of the First Dynasty*, I, 74.
8. Reisner, G.A., *Naga ed-Der*, I, 19 & fig. 10.
9. Grenfell, B.P., & Hunt, A.S., *Fayum Towns & their Papyri*, 51.
10. Frankfort, H. & Pendlebury, J.D.S., *City of Akhenaten*, II, 5-77.
11. *ibid.*, 28-30 & fig. 4.
12. Boak, A.E.R. et al., *Karanis*, 1924-8, 26 & Pls. XIX, XLI, fig. 81.
13. Reisner, G.A., *Mycerinus*, 92.
14. Borchardt, L., *Das Grabdenkmal des Königs Neferirkare*, 20-2.
15. Peet, T.E. & Woolley, L., *City of Akhenaten*, I, 5-6, 10, 41, Pl. V.
16. *ibid.*, 57-8.
17. Pendlebury, J.D.S., et al., *City of Akhenaten*, III, 86, 91, 108-9, 131-2 & Pl. LI.

Floors of wood are not common in Egyptian buildings, since far cheaper materials were available for this purpose, but they occur in tombs of the Archaic Period at Abydos and Saqqara. These floors are formed of planks laid upon joists, and in a number of cases they are surrounded by a shallow skirting board. Details of the arrangement of the woodwork have been given by the excavators.¹⁸ Two mastabas at Tarkhan had wooden floors in the main offering niche of the superstructure, consisting of several thick planks, in part overbuilt by the brickwork of the niche.¹⁹ Wooden floors were not used in domestic architecture, except for the floors of upper storeys, but this is really a matter of roofing.

Doorframes of timber are very common at all periods, mainly in domestic buildings, although they do occur elsewhere. The doorjambs were attached to the surrounding brickwork by wooden pegs,²⁰ or by their being jointed to blocks of wood set into the walls. The latter method was popular in houses of a very late period in the Fayum, in which beams were built into the brickwork for the full height of the doorway (pp. 90, 99). The threshold of the door usually consisted of a rough beam or plank, set across the step, and partly inset into the brickwork on either side. In the late houses mentioned above, the thresholds are sometimes more elaborate, being mortised to the sides of the doorframes.²¹ The purpose of a wooden doorstep was to protect the mud brick from wear, since the brick was softer than the timber. For the same reason, strips of wood were often laid across the leading edges of stairs, as in the stairway to the top of the temple wall at El-Kab.²² The stairs at Amarna were built over sloping beams, as shown in Fig. 58, but in a house of the Twenty-Fifth Dynasty at Medinet Habu each step was supported by a short beam laid transversely beneath it.²³ In later times the stairways were usually built over vaults.

Windows frequently had wooden frames, the best-preserved examples of which occur in the late houses of Karanis.²⁴ Long beams were employed above and below the window, running into the brickwork at each side, and the opening was divided into a series of slits by vertical bars of wood. (Fig. 88) An unusual form of window was used

Fig. 88 Window in House at Karanis.



to light the cellars of the building numbered II.201 at Dime, consisting of a single beam with two small apertures cut through it, set at ceiling level.²⁵ Wooden lintels were obviously used above windows from very early times, since they are clearly depicted on the house model from El-Amra,²⁶ which is of late Predynastic date.

Probably the most peculiar use of wood in Egyptian buildings is its employment in the structure of brick walls as a means of reinforcement. Generally speaking, this technique is most common in well-built walls of considerable thickness, but it can occur in house walls. In the best examples the timbers are laid at regular intervals, and they can run both along and across the wall, but in more careless building it is common to find irregular distribution or isolated beams at widely spaced points in the brickwork. The most elaborate timbering in Pharaonic architecture is found in the walls of temples and fortresses, as shown by the individual examples described in Chapters 5 and 8. In domestic buildings the technique is quite rare throughout this period, and only a few instances are recorded from the great number of houses at Amarna.²⁷ Timbering of house-walls does not become common until very late times, the vast majority of cases being found in the houses of the second to fourth centuries A.D. at Karanis, Dime and other Graeco-Roman towns of the Fayum.²⁸ It is rather strange that this practice should be so common at these sites, and yet infrequent in towns of similar age at Edfu and Elephantine, but possibly this may have been due to differences in the availability of the wood.²⁹ Timber reinforcement occurs to a limited extent in brick mastabas of the Old Kingdom,

18. Petrie, W.M.F., *Royal Tombs*, I, 8-16 & Pls. LXII, LXIV-LXVII.

Emery, W.B., *Great Tombs of the First Dynasty*, II, 11, Pls. XII-XIII.
ibid., vol. III, 40, Pls. 58-60.

19. Petrie, W.M.F., *Tarkhan*, II, 4. Petrie & Wainwright, G., *Tarkhan I & Memphis V*, 13, Pl. XV, 2.

20. Peet & Woolley, *op. cit.*, 58-9.

21. Boak, A.E.R., *Soknopaiou Nesos*, 11-6 & Pl. VI.

22. Somers Clarke, *JEA*, 7 (1921), 77. 23. Hölscher, U., *EMH*, V, 16.

24. Boak, A.E.R., et al., *Karanis*, 1924-8, 49, 57 & Pls. XXXI (61), XXXII (63), XXXIV (67).

25. Boak, A.E.R., *Soknopaiou Nesos*, Plan XVI.

N.B. Details of the construction of doors will be found in Koenigsberger, O., *Die Konstruktion der Ägyptischen Tür*.

26. McIver, D.R. & Mace, A.C., *El-Amrah & Abydos*, Pl. X, 1-2.

27. Borchardt, L., *MDOG* 46 (Nov. 1911), 24-5. 28. See above, pp. 98-100.

29. The house models from Xoïs and Memphis show that timbering was not limited to the Fayum; see *ASAE* 31 (1931), Pl. III and Quibell, J.E., *Excavations at Saqqara*, 1905-6, Pl. XXX, 4.

such as that of Rahotep at Meydum, which contained a large number of irregularly spaced logs.³⁰ The thin sticks found between the courses of bricks in mastabas of the First Dynasty³¹ are not to be considered as reinforcement, since they are used in the same manner as layers of reed-matting.

The strengthening of the corners of brick walls with timber occur in administrative buildings of the Middle Kingdom in the Nubian fortresses,³² and in the late houses of Karanis and Dime.³³ This technique can be compared with the stone reinforcement which sometimes occurs at the angles of temple enclosure-walls.³⁴ It is easy to see the reason for these corner timbers; in the narrow streets of Egyptian towns the angles of the houses would be liable to damage from the passage of laden baggage-animals, and the soft mud-brick could be displaced. The elaboration of corner protection in late houses was probably due to the fact that these buildings were several storeys high, and any damage to the brickwork at a low level could cause the collapse of a whole corner of the house.

It is far more difficult to explain the purpose of the timbers which occur throughout the structure of brick walls. The Egyptians evidently considered that the strength of the brickwork was improved by the inclusion of these beams, but they cannot fail to have observed that their presence was not essential. There are many examples of massive brick walls without any timber reinforcement, such as the great enclosure-wall of the Temple of Medinet Habu, which have survived the ages just as well as those walls in which wooden beams are present. This is not to say that the use of timber had no strengthening effect at all; the inclusion of any material with a high tensile strength would improve the stability of a brick wall, but the degree of improvement gained would be so slight that it does not seem to justify the enormous outlay of timber. It is interesting to note that great beams of cedar were inserted into the masonry of the Step Pyramid of Djoser,³⁵ again with little structural value, but their use in this building shows that the belief in the advantages of timbering began at an early date. The use of wooden baulks of great size in the buttresses of the bridge at Amarna³⁶ shows that the technique was certainly intended to give improved strength. In the walls of fortresses it is possible that another purpose may have been to prevent the walls being mined by an enemy.

There is a distinct difference between the timbered walls of the dynastic period and those of the very late houses of the Graeco-Roman towns in the Fayum. In the early examples, the timbers are rough logs, frequently branched and twisted, with the bark still in place. By contrast, the late houses are timbered with neatly cut and planed beams of square or rectangular section, which are more frequently laid longitudinally along the faces of the walls than previously. These beams also differed from the earlier type in that they were apparently not hidden by any plaster. In order to discover the reason for the change in technique, it is necessary to examine it at a still later stage, in the Coptic buildings at Bawit. The long timbers which occur in the walls of these structures are set flush with the face and are decorated with carved designs.³⁷ Shorter decorated beams or wooden panels are found at the angles of the doorjambs,³⁸ in similar style to the timber used around the doors of houses at Dime (page 100). Some of this Coptic timbering occurs in walls of stone, which shows that the wood was no longer considered to have any structural purpose connected with brick construction.

Consequently, the whole history of the use of wooden reinforcement in brickwork may be summarised as follows: The technique was initiated in the Archaic Period, and was considered to give improved stability to mud-brick constructions, especially those of considerable thickness. For this reason it was regularly used in the great walls of temples and fortresses, but was less common in domestic architecture. By late Roman times, however, the use of wood in houses increased greatly, but the purpose of this timbering was no longer entirely structural, since it had become partly decorative in intent. The process of transition from a structural device to a decorative motif was completed in Coptic architecture, in which carved designs were used on the wooden beams to heighten the decorative effect.

Wooden planks were occasionally used for lining brick walls, but examples are not common, no doubt because of the expense of the material. The greatest use of wooden lining occurs in the First Dynasty Royal Tombs of Abydos, some of which had entire burial chambers constructed of wood within the substructure.³⁹ In some cases the wooden structures stood clear of the walls, but in other tombs, such as that of Ka-a, the planks were applied over the face of the brickwork and fixed in place by being jointed to the beams of the roof and floor.⁴⁰ Wood-cased pilasters occur in Tomb 3504 at Saqqara, the planks being fastened to beams set into the brickwork (page 17). The same system of holding the wood in position was used in the funerary temple of Neferirkare,⁴¹ and it was probably employed

30. Petrie, W.M.F., *Medum*, 16.

31. Emery, W.B., *Hor-Aha*, 15 & fig. 5. *Idem.*, *Great Tombs of the First Dynasty*, I, 15.

Petrie, W.M.F., & Wainwright, G., *Tarkhan I & Memphis V*, 14 & Pl. XVI.

32. See above p. 84. 33. See above, pp. 90, 91. 34. See above, pp. 74, 78, 81.

35. Lauer, J.Ph., *La Pyramide à Degrès, L'Architecture*, II, Pl. CII, 2.

36. Pendlebury, J.D.S. et al., *City of Akhenaten*, III, 56 & Pl. XXXIX.

37. Chassinat, E., *Fouilles à Baoult*, I, fasc. 1, Pls. XV, XVI, XXI-XXIV, LVIII, LXIX, LXX.

38. *ibid.*, Pls. XXXVI, XXXVII, LXVI.

39. Petrie, W.M.F., *Royal Tombs*, I, 9-10, 15, & Pls. LXII, LXVII. *ibid.*, II, 7-10.

40. *ibid.*, I, 15 & Pl. LXVII.

41. Borchardt, L., *Das Grabdenkmal des Königs Neferirkare*, 37-8, Abb. 42.

throughout the Dynastic Period, although examples are not forthcoming. A different method was used in a very late administrative building at Dime, which had one room entirely panelled with wood. This panelling consisted of thick blocks of wood laid against the wall, mortised to similar beams set into the brickwork (page 90).

Stone

Stone casing on brickwork first appears in the tomb of Khasekhemui at Abydos,⁴² and becomes common in all later periods, especially in religious and funerary architecture. In mastabas or pyramids, the casing is thick and is composed of heavy blocks, but the stone lining on temple pylons or walls is much thinner, sometimes being less than 20cm. Stone casing of this kind is not attached to the brickwork in any way, but stands in position by weight alone, and the arrangement of the bricks is unaffected. The normal purpose of the casing was to give the appearance of being constructed of more enduring materials than was in fact the case. Less frequently, the stone had a specific function, such as the protection of the mud-brick walls of bathrooms from damp.⁴³

The use of stone in foundations has already been described in Chapter 10. Various kinds of stone were used for floors in brick buildings, most commonly in tombs and temples, but the use of the stone floor does not affect the brickwork.⁴⁴

Columns of stone are common in brick-built temples, official buildings and rich houses, such as that of Butehamun at Medinet Habu.⁴⁵ In certain cases these columns stood upon brick foundations, as described on page 120. Stone architraves were used in official buildings to support brick vaults, examples being found in the palace of Ramesses III at Medinet Habu⁴⁶ and in the storehouses of the mortuary temple of Merenptah.⁴⁷

Doorways of stone were frequently used in important buildings, and, by re-use, they could find their way into poor houses. The jambs of the door stood in place by weight, as did the lintel, except in some unusual examples at Medinet Habu, where the lintel was held in position by cords (page 87). Stone sills were regularly employed in all kinds of structures, even when the rest of the doorframe consisted of wood. Stone windows, in the form of grilles, were used in the palace of Ramesses III at Medinet Habu,⁴⁸ and other examples have been discovered in houses at Amarna.⁴⁹

The angles of temple enclosure-walls were sometimes protected by stone blocks, examples being recorded from Edfu, El-Kab, Luxor, Dendera and Abydos. (pp. 61, 74, 78 and 81). Such reinforcement was not really necessary in temple walls, but was copied from the use of timbers in the corners of houses. Very few houses have stonework at the corners of the walls, but one or two examples are known at Karanis.⁵⁰

Mortar and Plaster

The following types of mortar occur in Ancient Egyptian brickwork:⁵¹ (1) Mud mortar: the most common type, formed of ordinary Nile alluvium, and used at all periods in all kinds of buildings. (2) *Tafl* mortar: composed of desert gravel, with a high proportion of sand. Most common in small buildings on the desert edge, especially tombs. (3) Lime mortar: a hard, white mortar, used only in Ptolemaic and Roman times, usually in connection with burnt brick. Suitable for use in damp places, since it is impermeable to water.

The mortaring of Egyptian brickwork is usually rough, and is practically always restricted to the horizontal joints. Exceptions to this rule occur only on the outer faces of well-built structures, where both the horizontal and vertical joints are sometimes carefully pointed. Very little mortar was used in the heart of thick walls, the majority of the bricks being laid together dry. In certain buildings, such as the brick pyramids of the Middle Kingdom, a layer of sand was placed between the courses instead of any mortar. The vertical joints in thick structures can be very wide, as in the pylon of the tomb of Montuemhat at Thebes. (Pl.47A). A special form of joint occurs in the bonds A12 to A16, consisting of a wide space between the bricks filled up with gravel, or, less frequently, with plaster. The purpose of such a division is not clear; the inclusion of a mass of gravel may have helped to dry the brickwork, but no such effect could be gained from a wide joint full of plaster.

Lime mortar is found in Ptolemaic and Roman burnt-brick structures, especially baths and conduits, where it was necessary to make the joints waterproof. This mortar was not normally employed with mud-brick, but it occurs in arches of that material beneath stairways in the Coptic town at Armant.⁵²

42. Petrie, W.M.F., *op. cit.*, II, 13-4 & Pl. LVII, 4-6.

43. Hölscher, U., *E.M.H.*, IV, 30.

44. Early stone floors occur in Tomb T at Abydos and Tomb 3505 at Saqqara.

45. Hölscher, U., *E.M.H.*, V, 4-5.

46. *ibid.*, III, 38-9.

47. Petrie, W.M.F., *Six Temples at Thebes*, 12-3.

48. Hölscher, U., *E.M.H.*, IV, 34.

49. Woolley, L., *JEA* 8 (1922), Pl. IX.

50. Bouk, A.E.R. *et al.*, *Karanis*, 1924-8, 26 & Pl. XLII, 84.

51. Lucas, A. & Harris, J.R., *Ancient Egyptian Materials*, 74-6.

52. Mond, R. & Myers, O.H., *Temples of Armant*, 38 & Pl. XXXIX.

*Mud plaster:*⁵³

This is formed of alluvium, mixed with varying quantities of sand and chopped straw to prevent the formation of cracks on drying. The colour of the plaster depends upon the amount of sand and the composition of the mud, but the usual kind is a dark grey-brown. Yellow plaster was employed in the reign of Shepseskaf, in buildings at Giza⁵⁴ and Saqqara,⁵⁵ and in the Fifth and Sixth Dynasties black plaster was common.⁵⁶ Practically all Egyptian mud-brick structures were coated with a layer of mud-plaster, which was usually whitened by a second coat of gypsum. Apart from the common uses of plaster on floors, walls and vaults, it was also employed for a number of special purposes, such as the precast slabs of mud used to form the recessed panelling in tomb 3070 at Saqqara.⁵⁷ In late buildings at Tuna el-Gebel⁵⁸ and Theadelphia,⁵⁹ whitened plaster was moulded to imitate the appearance of well-laid blocks of limestone. A similar technique occurs in the Old Kingdom tomb of Desi at Saqqara, in which a coat of ordinary grey mud-plaster has been grooved to simulate well-bonded brickwork (Pl.46A). Painted decoration on plaster was usually applied over a coat of gypsum, but examples of painting directly on mud-plaster do occur, especially at Amarna.⁶⁰ Wooden roofing was generally covered with a layer of mud to render it weatherproof, but the extensive use of mud in the roofing of large rooms in the palace of Amenhotep III at Malqata is exceptional, and it led to an unnecessarily heavy roof.

Tafl plaster:

Tafl plaster consists of desert gravel, sand and chopped straw, with just sufficient clay in the mixture to bind the materials together. The use of this plaster is rather limited; it most frequently occurs in the superstructures and shafts of small tombs in desert cemeteries, in conjunction with *tafl*-bricks.

*Gypsum plaster:*⁶¹

White gypsum plaster was generally used as a finishing coat over mud-plaster, in all kinds of buildings. In most cases this plaster was left plain white, but it also formed an ideal surface for the addition of painted decoration, examples of which are common in tombs, palaces and rich houses at widely differing periods. Painted plaster is most frequently found on walls, but it also occurs on ceilings and floors, as in the palace of Amenhotep III at Malqata (pp. 87-8). In late tombs at Tuna el-Gebel, painted plaster was used to imitate the appearance of granite, porphyry and marble.⁶²

*Lime plaster:*⁶³

This type of plaster does not come into use until the Graeco-Roman period, when it was employed in burnt brick constructions as a water-resistant coating. For this reason it is found in the Sanatorium at Dendera⁶⁴ and in Roman baths and water conduits at Kom el-Ahmar, Edfu, Medinet Habu, and elsewhere.⁶⁵ In one bath at Edfu⁶⁶ the plaster on the floor and walls had been coloured pink, probably by the addition of powdered brick.

Reed Matting:

Layers of reeds are common in Egyptian brick structures of all periods, set at various levels in the brickwork. In walls, the reeds are usually laid transversely, but there are examples in which they run both along and across the axis of the wall. Reed-matting in brickwork first appears at an early date in the First Dynasty mastabas at Saqqara,⁶⁷ and

53. Lucas & Harris, *op. cit.*, 76.

54. Reisner, G. A., *Mycerinus*, 90.

55. Jéquier, G., *Le Mastabat Faraoun*, 16.

56. Reisner, *op. cit.*, 90.

57. Emery, W. B., *JEA* 54 (1968), 11-3.

58. Gabra, S., *Le Monument funéraire de Padykam*, 39 & Pl. VIII.

59. Lefebvre, G., *ASAE* 10 (1910), 169 & Pl. IV B.

60. Lucas & Harris, *op. cit.*, 354.

61. Lucas & Harris, *op. cit.*, 76-9, 471-2.

62. Gabra, S. & Drioton, E., *Peintures à Fresques et Scènes Peintes*, Pl. 21.

63. Lucas & Harris, *op. cit.*, 76, 469.

64. See above, p. 91.

65. See above, pp. 91-2.

66. Michalowski, K. *et al.*, *Tell Edfou*, 1 (1937), 65, 68.

67. Emery, W. B., *Great Tombs of the First Dynasty*, II, 8, III, 8, 41, 76.

thereafter it was employed in all kinds of buildings, except those built of burnt brick. The distribution of the reed layers in a single building is often quite regular, but differences occur between individual structures, as shown in the following list:

Location	No. of courses between reed-layers
Saqqara Tomb 3504	6
3036	6
3035	9
3506	5
Theban Tomb 158	4
34	4-6
Abydos: Seti Temple	4-5
Medinet Habu: Ramesses Temple	2
Saqqara: XXXth. Dyn. walls East of Teti Pyramid	2
Karnak: Great Enclosure wall	2
Kuban: Fortress	8
Mirgissa: Fortress	12
Uronarti: Fortress	6

The purpose of the reeds must be structural, and it has been suggested⁶⁸ that they were intended to dry the interior of the brickwork by conducting moisture to the outer face. This is a possibility, but there are a number of objections to the theory. In the first place, the reeds are sometimes laid longitudinally, and therefore would not draw water outwards; secondly, the outer face of the brickwork is invariably covered with a layer of plaster, through which the reeds do not penetrate. Consequently, the matting is sealed in by the plaster and there is no free escape for the moisture. The construction of air-channels in thick walls to ensure drying of the brickwork suggests that the reed-layers are not connected with the problem of damp but have a separate purpose. It is possible that they were intended to assist the bonding of the brickwork by forming a 'key' for the mortar, and also by covering any irregularities which developed in the course of construction. This hypothesis is supported by the fact that some of the earliest examples of this technique, is mastabas at Tarkhan and Saqqara, have rows of thin sticks in place of reeds.⁶⁹ These sticks would have been of no value for drying the brickwork, but they could have improved the bonding between the courses. Another valuable piece of evidence comes from a vaulted cellar at Amarna,⁷⁰ in which two long reeds have been placed between the rings of bricks in the vault (page 95). The function of these reeds is obviously the same as that of the grooves which usually occur on bricks in this type of vault, that is to provide a key for the mortar. The reed-layers in walls probably had a similar purpose, and they would have provided points at which the levelling of the courses could be checked or adjusted, as seems to have been done at Mirgissa.⁷¹

Reeds were also employed in roofing, in conjunction with wooden beams and planks. Early examples of this use are found in the substructures of First Dynasty tombs,⁷² and later it becomes common in all kinds of buildings. An unusual use of reed-matting was discovered in tombs 3357, 3503, 3504 and 3505 at Saqqara, where the mats had been coloured and attached to the walls as decoration.⁷³

68. Petrie, W.M.F., *Egyptian Architecture*, 8.

69. Emery, W.B., *Hor-Aha*, 15 & Fig. 5. Petrie, W.M.F. & Wainwright, G., *Tarkhan I and Memphis V*, 14 & Pl. XVI.

70. Frankfort, H. & Pendlebury, J.D.S., *City of Akhenaten*, II, 52-3 & Fig. 6.

71. Dunham, D., *Second Cataract Forts*, II, 156.

72. Emery, W.B., *Great Tombs of the First Dynasty*, I, 16; II, 9, 11, 133.

73. *ibid.*, II, 11, 133; III, 10 & Pl. 25 b. *Hor-Aha*, 17.

CHAPTER FOURTEEN: BONDING

The bonds A1, A2 and A3 are by far the commonest forms of bonding in Egyptian brickwork of the Dynastic Period, and their use is continued, although to a lesser extent, in Graeco-Roman and Coptic buildings. The thickness of a wall very often influences the arrangement of the bricks; bonds A2 and A3 are very similar, except for the fact that A2 is used where the thickness of the wall corresponds to an odd number of bricks, and A3 where the number is even. Bond A1 is found in Egyptian buildings of all periods, mainly in thin walls, although it can occur infrequently in thick masses of brickwork, such as mastaba casings or great enclosure walls. However, the usual procedure in thick walls was to discard A1 bonding in favour of A2 or A3, which are the standard arrangements in these structures. Practically all the great walls of dynastic age are constructed in these bonds, and although in the immensely thick enclosures of forts and temples it is inevitable that some irregularities occur, nevertheless the arrangement is very consistent.¹ Bonds A2 and A3 are by no means restricted to massive walls, for they occur frequently in walls of moderate dimensions in all kinds of architecture, the thinnest examples being common in houses and tombs. The arrangement of the bricks in A2 bonding is such that no wall can be built in this way with a thickness less than 1.5, and with A3 bonding the minimum thickness is 2.0.²

More variation in bonding occurs in the construction of pit-graves and mastabas of the Archaic Period. The simplest pits have lining-walls of stretchers, only 0.5 thick, and therefore out of necessity bonded X1. This is the only possible arrangement of the bricks in walls which are a single brick-width across, and consequently it occurs at all periods in such walls. The only thick structures in which X1 bonding appears are the sinusoidal walls around the pyramids of Mazghuneh and South Saqqara. X2 bonding is found in the lining of the Decorated Tomb at Hierakonpolis, and in the retaining wall around the site of the Solar Temple of Neuserre at Abu Gurab, but otherwise it is uncommon except in buttresses and door-blockings. Frequent use is made of A1 bond in early graves, but the alternation of three courses of stretchers with one of headers (A8) also occurs, especially in Upper Egypt, at El-Amra³ and Naga ed-Der.⁴ At the latter site, this arrangement is retained in walls which are 1.5 or 2.0 thick by the use of bonds A5 and A7, both of which are rare elsewhere. These bonds gradually fall out of use towards the end of the Archaic Period, to be replaced by A2 or A3, but the process of transition seems to have been slower in the Thinite area than at other sites.

A number of brick-bonds are recorded from the First Dynasty mastabas of Saqqara, but it is not certain whether they all really exist, since the descriptions given by Emery do not always agree with his drawings,⁵ nor with the remains of the monuments on the site. For this reason I have preferred not to assign Corpus numbers to some of these bonds,⁶ until the uncertainty is resolved by their discovery in other buildings. The bond C5, however, was numbered in the Corpus before the discrepancies became apparent, and it should be noted that this also may not exist. I suspect that this bond is the result of misinterpretation of the courses of edger-headers which occur frequently in Egyptian brickwork for levelling purposes; these have been drawn as though they were set regularly at every fifth or sixth course, to produce an ordered bond, whereas in reality these edger courses are irregularly distributed and do not run through the whole structure. In all probability the walls which are supposed to have been built in this bond were really constructed in some form of Class A bonding, with levelling courses of bricks on edge here and there. Some A7 bonding does occur in mastabas 3504 and 3506 at Saqqara, but A1 is more common. Other First Dynasty tombs are built entirely of headers, in the system described in Chapter 12. In the mastabas of the Second and Third Dynasties, at Saqqara and elsewhere, bonds A1, A2 and A3 replace nearly all the earlier varied forms, but a fair amount of A6 is found in the thick casing-walls.

As all Dynastic brickwork is dominated by the use of bonds A1, A2 and A3, we will here examine only the occurrences of the less common bonding systems. Most exceptional is the use of C1 bonding in the walls of the tomb of Semerkhet at Abydos,⁷ and CE1 in a mastaba of the First Dynasty at Abu Roash,⁸ since the employment of bricks on their edges in this way is extremely unusual prior to the Graeco-Roman Period. The only other examples of Class C bonds in Dynastic brickwork (excluding small structures such as door-blockings) occur in the storehouses at the Ramesseum, and in a tomb-vault of the reign of Nectanebo II in the Baqaria at Armant (pp. 55 and 86).

1. Christophe, L., *Karnak-Nord*, III, Pls. XVII-XIX. Jacquet, J., *BIFAO* 69 (1971), Pl. XXXIII.

Hölscher, U., *E.M.H.*, II, Pls. 16-7.

2. These thicknesses are in terms of brick-lengths, as explained on page 7.

3. McIver, D. R. & Mace, A. C., *El-Amrah and Abydos*, 35.

4. Reisner, G. A., *Naga ed-Der*, I, 27.

5. Emery, W. B., *Great Tombs of the First Dynasty*, II, 130, figs. 201-2, Pl. XLVI; *ibid.*, III, 41 & Pl. 41, 76 & Pls. 86, 92-4.

6. In the chart on p. 21 these bonds are given in terms of headers and stretchers.

7. Petrie, W. M. F., *Royal Tombs of the First Dynasty*, I, Pl. LXVI, 3-4.

8. Montet, P., *Keml*, 7 (1938), 39 & Pls. X, 1 and XI, 1.

In the Middle Kingdom Temple of Hermopolis there is a certain amount of A9 bonding in the wall of the forecourt,⁹ and the Late-Period houses at the same site had walls 1.5 and 2.5 thick constructed in A4 bonding.¹⁰ The use of bricks set at an oblique angle, as in bonds A17 and A18, is infrequent in Dynastic buildings, but becomes more common in Ptolemaic and Roman architecture, examples being recorded from Medinet Habu¹¹ and Armant.¹²

Bonds A12 to A15 were originally published in *Temples of Armant*, by O.H. Myers, and are said to have been found in the tombs at that site.¹³ Unfortunately, these tombs were never published, since the second volume of the cemeteries did not appear, so it is not possible to say precisely where these bonds were used. I have not found any examples of bonds A13, A14 or A15 at any other sites, but this is probably due to the scanty records of brick bonds in publications, and the fact that I was only able to examine a limited number of sites myself. Bond A12, however, exists in buildings of the Thirtieth Dynasty at Saqqara.¹⁴

A10 bonding is found in the pyramid-temples of Mycerinus at Giza,¹⁵ and in Late-Period buildings at Saqqara, and may have been in fairly common use throughout Dynastic times. A characteristic arrangement of the bricks at the corners is associated with A10 bonding, although it does occur in other systems, particularly at the angles of the separate panels in undulating enclosure-walls (Plates 50A–B).

In Graeco-Roman buildings, greater use was made of Class C bonds than previously, and the number of different arrangements in this group is increased. This trend continues into Coptic architecture, in which Class C bonding becomes very common, and results in a decrease in the use of bonds A1, A2 and A3, although these still remain in regular use. Bonds of types B and D appear in brickwork of late Roman age, as do the complex systems AC1 and AD1.¹⁶ Some of these more complex bonds had a decorative purpose, a technique totally absent from Egyptian brick building prior to this period, all the earlier work being hidden under a thick coat of plaster. The increasing taste for decoration in brickwork is also seen in the insertion of patterns of red burnt-brick into the walls of Coptic houses. The spread of the new forms of bonding is most marked in walls of moderate thickness, and the great temple-enclosures of the Graeco-Roman Period are still constructed in Class A bonding.¹⁷

In the construction of arches and vaults a number of different bonds occur, some of which last throughout Egyptian history, whilst others are short-lived. Types c1 and d1, which first appear in the Archaic Period, belong to the former group, being in very common use at all periods. Small arches of x1 or c1 form are found in the substructures of pit-graves of all ages after the Third Dynasty. From the Old Kingdom to the Late Period, thick arches of several rings of brickwork were usually built in the composite bonds cd1, cx1 or cx2, although some examples were entirely constructed in c1 bonding. The bonds bc1 and bd1 also occur, but far less frequently. Very rare are the arrangements f1 and fd1; the only examples of the former are in the tomb of *ḥw-ḥb-Rc* Hor at Dashur,¹⁸ and the latter is recorded from a tomb of the Fifth Dynasty at Matmar.¹⁹

In Graeco-Roman buildings, the systems a1, d2, f2 and e1 come into use, but only e1 lasts into the Byzantine Period. The composite bonds bd1, bc1, cd1 and cx1 are no longer used to form very thick arches, but occur regularly in arches and vaults of two or three courses in domestic architecture. Strong arches, such as those in the enclosure-wall of the Temple of Dendera, are constructed entirely in c1 bonding.

A brief summary of the chronological distinctions between the different types of arches and vaults is included in the list below, where similar information for the bonds of walls and other structures is given (page 138).

There is a difficulty concerning the bond a2, published by Myers in *Temples of Armant*.²⁰ This arch is not recorded to have been used in the Coptic Town at that site,²¹ and therefore it must be derived from the tombs which were intended for publication in *Cemeteries of Armant, II*, a volume which never appeared. Consequently, it is not possible to assign a date to the use of the bond a2, since I have not found any other example of this type of arch.

9. Roeder, G., *MDIK* 7 (1937), Pl.4a.

10. Roeder, G., *Hermopolis*, 1929-39, 9 & Pl.12.

11. Hölscher, U., *E.M.F.*, V, Pls.24-5.

12. Mond, R. & Myers, O.H. *Temples of Armant*, 13.

13. *ibid.*, 39 and Preface, and Pl.XXXIV.

14. See note 193 on p.72.

15. Reisner, G.A., *Mycerinus*, 89-90.

16. Mond, R. & Myers, O.H., *The Bucheum*, I, 50-2; III, Pl.CXII.

17. An exception to this rule is the massive Roman wall between the Temple of Amun & that of Amun-hearer-of-prayers, Karnak.

18. De Morgan, J., *Fouilles à Dachour*, Mars-Juin, 1894, 89, fig.208.

19. Brunton, G., *Matmar*, Pl.XIX.

20. Mond, R. & Myers, O.H., *Temples of Armant*, Pl.XXXVI.

21. *ibid.*, 36-48.

Bond	Brick Bonds and Chronology Dating on present evidence
X1	Fairly common at all periods in thin walls. Only bond possible in wall thickness of 0.5.
X2	Not common, but examples occur at widely separated periods. Frequent in door-blocking.
A1 A2 A3	Extremely common at all periods, but reduced slightly in late Roman and Coptic buildings by increasing use of Class C bonds.
A4	Late-Period, not common.
A5 A7 A8	Archaic Period: common in Upper Egypt, especially at Naga ed-Der. Some A8 persists in Old Kingdom, but is rare later.
A6	Archaic Period, especially Dynasties II-III. Fairly common in mastabas.
A9	Old and Middle Kingdoms: not common. More frequent in Graeco-Roman mud-brick construction.
A10	Examples in Old Kingdom and Late Period. Probably in use at all times, but not very common.
A11	Only recorded in the enclosure wall of Saqqara Tomb 3357, of the First Dynasty.
A12	Thirtieth Dynasty. Also earlier at Armant (page 137).
A13-A15	Only recorded at Armant, date uncertain (page 137).
A16	New Kingdom, rare.
A17-A18	Late Period and Graeco-Roman: not uncommon. Bricks occasionally were set obliquely in earlier work, but only as rough irregularities. ²²
B1	Roman. Occurs infrequently at earlier periods, but only in door-blockings and similar structures.
B2 B3 B4 Irregular Class C	Roman. Type B3 also occurs in Coptic buildings. Common in Graeco-Roman and Coptic periods. One example in the Nineteenth Dynasty.
C1	Extremely rare in Dynastic brickwork. (One example from the Archaic Period and one from Dynasty XXX). Becomes increasingly common in Graeco-Roman buildings and by Coptic times it occurs more frequently than Class A bonding.
C2 C3 C4	Late Roman and Coptic. Fairly common.
C5	First Dynasty, in mastabas at Saqqara. (This bond may not exist, see page 136).
C6 C7 C8	Late Roman and Coptic: C6 fairly common, C7-8 less so.
D1 D2	Late Roman: not common.
AC1 AD1	Late Roman: not common.
CE1	First Dynasty. (Only one example).

Arches and Vaults

a1 d2 e1 f2	Only recorded from Graeco-Roman buildings, except for e1, which continues into the domestic architecture of the Byzantine Period. Only one example of type f2 is known.
cd1 cx1 cx2	Regularly used in thick arches from Old Kingdom to the Late Period. Also in small arches at all periods. Type cd1 is common in Graeco-Roman houses.
bc1 bd1	Used occasionally in thick arches in the New Kingdom. Few instances in tomb substructures of the Middle Kingdom. Common in Graeco-Roman and Coptic houses.
bx1	Common in small arches in Graeco-Roman and Coptic architecture, Rare in Dynastic buildings.
x1	Common from the Old Kingdom onwards. Used over wide spans in Graeco-Roman buildings.

22. Ricke, H., *Das Sonnenheiligtum des Königs Userkaf*, I, Plan 6.

Bond	Arches and Vaults
b1	Uncommon at all periods.
c1	Very common from the Third Dynasty onwards, in small and large arches.
c2	Only one example recorded, in an Old Kingdom tomb at Dashur. (page 28).
d1	Extremely common at all periods from the Late First Dynasty. Used in small and large vaults, the largest spans being found in the New Kingdom.
f1	Only two examples recorded, in the tomb of King Hor at Dashur.
fd1	Only one example recorded, in a tomb of the Fifth Dynasty at Matmar (page 137).

From the information given above it can be seen that the bonding of the brickwork is of some value in establishing the date of Egyptian buildings. The most useful features are the transition from Class A bonds to Class C in the Graeco-Roman Period, and the introduction of new bonds in the later Roman age. A difficulty is created by the very frequent and long-lived use of A1, A2 and A3 bonding, which makes them of little use for dating purposes. However, by combining all the information concerning bonding, brick sizes, and types of mortar and plaster it is usually possible to assign buildings to a particular period, even if the brick bond alone is not distinctive.

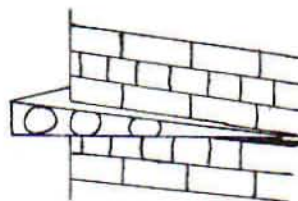
CHAPTER FIFTEEN: SPECIAL BRICKS

Burnt Brick

The use of burnt brick in Egypt did not become common until the Roman Period, but there is sufficient evidence to show that the material was known from a very early date, although used infrequently. Long bars of baked clay were employed in the Predynastic grain-kilns at Abydos¹ and Mahasna,² and, while these cannot be called bricks, they show a knowledge of the effect of baking on ordinary mud. It is impossible that the early Egyptians were unaware of the fact that mud-bricks could be hardened by burning, since they could have observed this process in any building which, by accident or design, was gutted by fire. Several examples of this accidental production of burnt brick occur in the large First Dynasty tombs at Saqqara,³ due to their having been burnt by plunderers, and similar cases must have been fairly common. However, we have, as yet, no evidence that the Egyptians deliberately prepared burnt bricks for use in buildings during the Archaic Period or the Old Kingdom, the earliest examples of their use being in the Middle Kingdom fortresses in Nubia, in which they were used as paving-slabs.⁴ These slabs, which measure 30 x 30 x 5cm, were employed because of their greater resistance to wear and to damp, compared with mud brick.

No more instances of the use of burnt brick are recorded until the time of the New Kingdom, when they occur in conjunction with funerary cones in the superstructures of tombs at Thebes.⁵ The ordinary cones were the wrong shape to be fitted at the corners of the frieze above the tomb entrance, and so rectangular burnt bricks, stamped with the name and titles of the tomb-owner, were used in their place (Plate 37). These bricks were also set in the angles of the mud-brick superstructure, independently of the funerary cones, for which purpose they were made in the form of a wedge, so that they would project from the corner and display the inscription.⁶ (Fig.89). However, this was not the only reason for their presence, since the projecting burnt bricks were also intended to protect the angle of the softer mud-brick wall. Such protection was unnecessary in tomb architecture, and this practice seems to be a slavish copy of a technique which was employed in domestic buildings,⁷ to prevent damage to the corners of houses by the passage of traffic in the streets. The reinforcement of house corners was usually formed of wood, and examples are known from the Middle Kingdom and the Graeco-Roman Period, although the technique may well have been in use at other dates. In funerary architecture, where the intention was decorative rather than functional, burnt bricks were substituted for wood, since they could be easily inscribed. Most of the private stamps on bricks are derived from this usage (page 146 and Plate 37).

Fig.89 Burnt brick set in corner of mud-brick wall.



Burnt brick appears as a constructional material in two tombs of the Twentieth Dynasty at Nebesheh,⁸ and in a wall of pre-Saite times at Deffeneh.⁹ From the Twenty-First Dynasty, the use of burnt brick increases, the following examples being recorded:

1. Peet, T.E. & Loat, W.L.S., *Cemeteries of Abydos*, III, 1-7 & Pl.I.
2. Garstang, J., *Mahasna and Bet Khallaf*, 7.
3. Emery, W.B., *Archaic Egypt*, 180.
4. Dunham, D., *Second Cataract Forts*, II, 119, 148.
5. Borchardt, L. et al., *ZAS* 70 (1934), 25-35.
6. Borchardt et al., *op. cit.*, 32-3.
7. See pp. 132.
8. Petrie, W.M.F., *Tanis*, II, *Nebesheh & Deffeneh*, 18-9.
9. *ibid.*, 58.

Date	Location	Use	Page
XXI	Medinet Habu	Floor of private house.	98
XXII	Medinet Habu	Floor of house IV.	98
XXII	Karnak	Walls of Takeloth shrine	77
XXII	Karnak	Walls of Osorkon II chapel. ¹⁰	
XXV	Karnak	Stairs in building of Taharqa by Sacred Lake.	74
XXV	Medinet Habu	Floor in tomb 20b.	52
XXVI	Karnak	Osiris cenotaph of Necho.	74
pre-XXX	Karnak	Burnt brick plaques against face of enclosure wall of Montu temple.	73
XXVI-Ptol.	Suwa	Underground tombs.	50
Alexander I	Armant	Ramp of tomb 31 in the Baqaria.	56
early Ptol.	Dendera	Walls around baths in the Sanatorium.	91

Burnt brick occurs more frequently in the architecture of the Graeco-Roman Period, but it does not become common until the second half of the First Century. All the earlier examples of its use, quoted above, show that burnt brick was usually employed in places exposed to excessive wear or damp, such as floors and underground constructions, whilst for general building purposes, ordinary mud-bricks were quite satisfactory. The same considerations affect the use of burnt brick in Roman and Coptic houses, for although the material is more common, it is still restricted to floors, thresholds, stairs, conduits and baths, and does not occur to any large extent in ordinary house-walls. This shows that burnt brick was only employed in the domestic buildings of this period when there was some distinct advantage to be gained from it, and there can be no doubt that the examples of its use from Dynastic times were motivated by the same reasons. In the religious or official monuments of the Roman Period such restrictions on the use of burnt brick were not observed, and the entire structure could be composed of this material, as shown by buildings at Alexandria and Thebes.¹¹ It is quite common to find mixed construction in buildings of Roman and Coptic date, with burnt bricks appearing singly or in groups in a mud-brick wall, but this is probably due to the builders making use of those materials which were most readily available. However, in a few cases, especially in Coptic and Byzantine architecture, the insertion of burnt brick into the wall had a decorative purpose, as in houses at Medinet Habu¹² and Edfu.¹³ In the latter example, the burnt bricks form the outer course of an arch over a window, whilst the inner course is formed of mud brick.

From the foregoing, it must be concluded that burnt brick was known in Egypt at all periods, but used only when its durability would give particular advantages over mud brick. In Roman and Coptic times this rule is still partly true, but only in domestic architecture, since burnt brick was used more extensively in Roman official and religious buildings.

Tafl-bricks

These bricks are composed of yellow desert gravel (*tafl*) and sand, with little or no addition of chopped straw. They are usually of small size, and are found in the construction of private tombs in desert cemeteries and, to a lesser extent, in houses. Small and medium-sized mastabas of the Archaic Period and Old Kingdom are sometimes built entirely of *tafl*-bricks, a good example being the tomb of Sebekemkhet at Saqqara.¹⁴ It is common to find *tafl*- and mud-bricks mixed in the construction of a single tomb. The use of these bricks in small tombs, and their absence from large official or religious buildings, suggests that they were made as required on the desert to avoid the labour of bringing mud bricks from a distance. Buildings constructed of *tafl*-bricks usually have mortar and plaster of the same material.

Bricks of Special Shape

The Egyptians made use of a wide range of specially-shaped bricks for certain purposes, such as the burnt frieze-bricks described above (page 140) and the square paving-slabs discussed in Chapter 10. The majority of special bricks, however, occur in the construction of arches and vaults, the commonest type being the thin brick employed

10. Chevrier, H., *ASAE* 51 (1951), 554.

11. See above, pp. 79-80, 89.

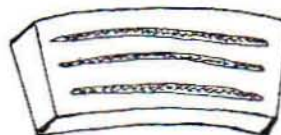
12. Hölscher, U., *E.M.H.*, V, 47.

13. Michalowski, K. *et al.*, *Tell Edfou*, III, (1939), 153-4.

14. Lauer, J. Ph., *ASAE* 55 (1958), 207-51. Other examples: Quibell, J. E., *Excavations at Saqqara*, 1912-4, 22-3, 36-7.

for vaults of d1 form. These bricks are of various sizes at different periods, but the ratio of the length: breadth: thickness is 6:3:1, as compared with 6:3:2 for ordinary bricks. The reason for making the bricks thinner than usual was to reduce their weight, so that they would be sufficiently light to be held in position by the mortar during the construction of inclined vaults. To help improve the cohesion of the mortar, the bricks are scored on the large faces with several grooves, as shown in Plate 53B. Some bricks of this type have their long sides of unequal length, so that they assume a wedge-form better suited to the construction of vaults (Fig. 90). Thin bricks are also common in vaults of type x1, but in this case they are not really necessary, since such vaults were built over temporary centring.

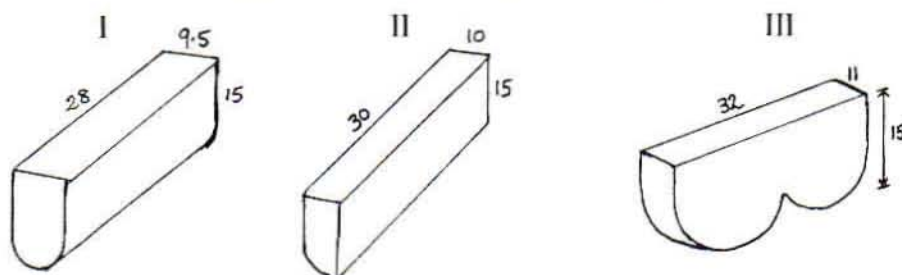
Fig. 90 Special type of Brick found in d1 vaults.



In the vault d2, which does not come into use until the Graeco-Roman Period, thin, square burnt-bricks measuring 26 x 26 x 7cm were employed.¹⁵ Special bricks of true voussoir form were used in e1 vaults, which are also of Graeco-Roman date.¹⁶

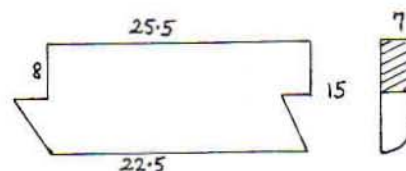
An interesting series of vault-bricks has been found in tombs of the Old Kingdom at Giza,¹⁷ but the special shape of these examples is partly decorative in intent. The bricks are curved on one edge to a semicircular or quadrant form, so that when assembled in a vault they produce transverse ribs on the interior of the roof, in imitation of a vault of dried reeds.¹⁸ Three different kinds of such bricks are shown in Fig. 91, with their dimensions. Types I–II were intended for use in d1 vaults, but type III was used in arches of c1 form.

Fig. 91 Special Vault-Bricks from Tombs at Giza.



In tomb 3033 at Giza, these moulded bricks are further specialised by having a projection at each end, so as to interlock with each other¹⁹ (Fig. 92). Details of the vaulting formed of these interlocking bricks are given on page 123.

Fig. 92 Interlocking Brick from Tomb 3033 at Giza.



Special bricks were used for making cornices above doorways and on pylons in the New Kingdom tombs of Deir el-Medina and Dira abu'l Naga.²⁰ These bricks are of fairly large size, so that the front part could safely overhang to form the cornice without risk of the brick falling (Fig. 93 on p. 143). Type III of this group was certainly intended for use at corners, since it is moulded on two sides.

Columns built of shaped bricks have been found in buildings of widely differing age, but in some cases the details of construction have not been reported. This is true of the columns in the temple storehouses at Amarna,²¹ and the circular brick piers in the Military Quarters at the same site.²²

15. Mond, R. & Myers, O.H., *The Bucheum*, I, 51.

16. *Ibid.*, III, PL.CXIII.

17. Fisher, C., *The Minor Cemetery at Giza*, 65, 106, 117. Junker, H., *Giza*, IX, 143.

Badawy in Abu Bakr, A.M., *Excavations at Giza*, 1949-50, 130-1.

18. Junker believed that the vault imitated wooden construction, see Junker, H., *Giza*, IX, 143.

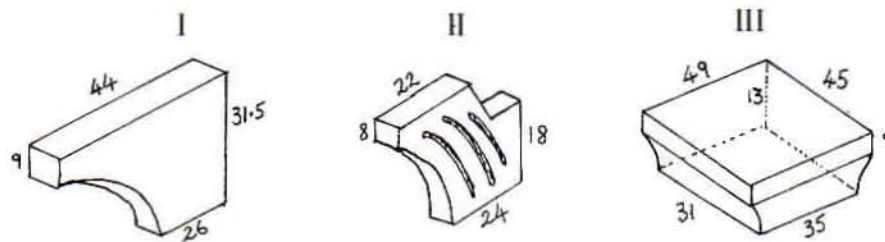
19. Fisher, C., *The Minor Cemetery at Giza*, 115-7.

20. Bruyère, B., *Deir el-Medineh*, 1924-5, 39. *ibid.*, 1930, 30. Similar bricks occurred in the funerary temple of Tuthmosis III (See above, pp. 66).

21. Pendlebury, J.D.S., *et al.*, *City of Akhenaten*, III, 22, 109.

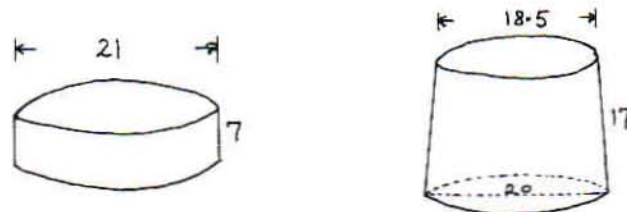
22. *ibid.*, 132.

Fig.93 Cornice-Bricks from Deir el-Medina.



Square bricks, measuring one cubit (52.3cm) along each side, were used for pillars in the Old Kingdom mastaba of Kaem-heset at Saqqara.²³ In Coptic buildings at Medamud, two circular burnt bricks have been found²⁴ which were intended for use in columns, and their dimensions are given in Fig.94. The second example may have been employed in a column with a tapering shaft, because the diameter of the brick is greater at the base than at the top.

Fig.94 Circular Column-Bricks from Medamud.



A more unusual technique occurs in the Roman temple at Deir el-Hagar in Ed-Dakhlah Oasis, where the columns are composed of segmental bricks, each making up one-fifth of the full circle.²⁵ Such bricks are also known in quadrant form, in the tomb-chapels of early Coptic times at El-Bagawat in Kharga,²⁶ whilst triangular bricks were used in columns in the Roman fort of Luxor.²⁷ The walls of Roman baths were often built of hollow burnt bricks, so that the heating air could be circulated through them (page 92).

Occasionally, bricks of unusual shape are found in a situation where there is no structural reason for their use, an example being the square bricks used in tombs of the Late Period at Sais (page 50). Ordinary Egyptian building-bricks were always rectangular, the breadth being approximately equal to half the length, but in the town sites near the Asiatic frontier of Egypt square bricks become common after the Twenty-Second Dynasty.²⁸

Bricks of Exceptional Size

In certain large mastabas of the Archaic Period, a special form of brick, of very small size, was employed in the construction of the palace-facade niches.²⁹ These bricks do not occur in all panelled mastabas, and they vary in size from one tomb to another, as shown in the list below:

Tomb	Size of Bricks (cm)
Naqada mastaba	17 x 9 x 7
Tarkhan 2050	17.3 x 8.6 x 6.6
Tarkhan 1060	15 x 7 x 7
Saqqara 3035	17 x 5 x 5
Saqqara 3506	15 x 7 x 7
Saqqara 2405	14 x 7 x 7
Saqqara 3070	10 x 5 x 5
Giza T	15 x 7 x 6.5

23. Quibell, J.E. & Hayter, A.G.K., *Teti Pyramid, North Side*, 20.

24. Bisson de la Roque, F., *Medamoud*, 1927, 31.

25. Winlock, H.E., *Ed-Dakhleh Oasis* 33.

26. Fakhry, A., *El-Bagawat in Kharga Oasis*, 22-3.

27. Lacau, P., *ASAE* 34 (1934), 18.

28. Petrie, W.M.F., *Anthedon*, 7. *idem*, *Gerar*, Pls. IX-XI, LXXII.

29. Details of palace-facade mastabas are given on pp. 15-21.

The development of these bricks may be traced as follows: They were introduced to deal with the problem of building the complex niches of Archaic mastabas, and first used at Naqada, in their larger size of 17cm long. They are absent from tombs of the reign of Djer, but appear in two sizes under Uadji at Tarkhan, and in tombs of the reign of Udimu at Saqqara. After Udimu they fall out of use as the palace facade itself disappears towards the end of the First Dynasty. The revivals of the panelled mastaba in the Archaic Period use bricks of similar dimensions to the smaller of the First Dynasty sizes, except in tomb 3070 at Saqqara. The two sizes which appear regularly are 17 x 9 x 7cm and 15 x 7 x 7cm, which, allowing for the roughness of the material and the probable approximation of the measurements, may represent 1/3rd x 1/6th cubits and 2 x 1 palms respectively for the length and breadth. An examination of the metrology of the palace facade is given in Appendix I.

Some extremely large bricks occur in Egypt, but all the examples have been found loose, so it is not known for what purpose they were intended. Several bricks near the mastaba of Iyner at Dashur³⁰ had the staggering size of 1.10 x 0.56 x 0.30m, which means that their weight must be in the region of 230kg. Engelbach records finding three bricks in the shaft of tomb 305 at Riqqeh,³¹ each measuring 71 x 35.5 x 30.5cm, and other examples have been found at Abydos,³² 61 x 30.5 x 11.5cm in size. All these bricks would be too heavy and inconvenient for normal use, so they were probably made specially to fulfill a particular purpose, of which we have, as yet, no knowledge. The largest bricks which occur in buildings are 53cm in length, or one Egyptian cubit, and examples of their use have been found in monuments of the Old Kingdom at Saqqara³³ and Naqada.³⁴

Bricks with Royal or Official Stamps:

The practice of stamping mud bricks with a royal name, or with the name of the building in which they were to be used, begins in the early Eighteenth Dynasty and continues regularly until the Nineteenth, after which it appears more intermittently down to the Twenty-Sixth. Most brick stamps give only the name of the Pharaoh, but some bear the name of the queen also. The names are written inside a simple oval, or in a true cartouche, but there is no chronological distinction between the two types. The High-Priests of the Twenty-First Dynasty sometimes enclosed their names in a rectangular frame instead of a cartouche. Stamps giving the names of buildings are frequently written inside the rectangular enclosure, which occasionally forms the hieroglyph for *hwt* "mansion", and is then to be read as part of the inscription.

Drawings of a large number of stamps are given in Plates 21-36, and although every effort has been made to include all the published stamps, the list cannot be claimed to be exhaustive, since I have not attempted to give the many unpublished bricks now in various collections.

The earliest stamp which I have been able to find is that of Amosis I, on the bricks from his cenotaph at Abydos.³⁵ It is strange that the practice should begin so suddenly, without any previous occurrence, not even in the large brick monuments of the Middle Kingdom.³⁶ The Eighteenth Dynasty bricks occur mainly at Thebes, especially in the mortuary temples. Under Tuthmosis I, not only do bricks of the Pharaoh himself occur, but also of the Prince Wadjmose, all the examples having been found at Deir el-Medina. No bricks of Tuthmosis II have yet been discovered, but this may be due to his short reign and the destroyed state of his mortuary temple. Hatshepsut has a variety of stamps, derived from her Valley Temple at Deir el-Bahari and from the Small Temple of Medinet Habu. One example has a joint inscription of herself and Tuthmosis I. The stamps of Tuthmosis III are found at Naqada and Gurob as well as at Thebes. There is considerable re-use of bricks from his mortuary temple in later tombs at Qurna, at the Ramesseum and at Medinet Habu. The name of the funerary temple is given on several bricks from its enclosure wall as *Mn-hpr-rc hnkꜣt cnḥ*. One example, found re-used at Medinet Habu, gives the name of a building as *šꜣp kbḥ Mn-hpr-rc mrꜥ ʿmn*, which must refer to some unknown temple in the Theban district. Apart from the listed stamps of Tuthmosis III, there are two unpublished bricks in the Metropolitan Museum of Art, New York, which read *Mn-hpr-rc nb pḥty* and *Mn-hpr-rc hḳꜣ wꜣst*.³⁷

30. Barsanti, A., *ASAE* 3 (1902), 204.

31. Engelbach, R. & Petrie, W.M.F., *Riqqeh & Memphis VI*, 3.

32. Petrie, W.M.F., *Abydos*, II, 50, 52.

33. See above, p. 27.

34. Petrie, W.M.F., *Naqada and Ballas*, 66.

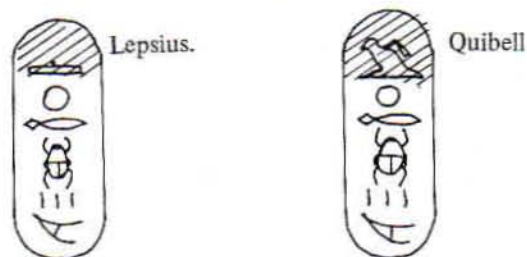
35. References to all the published bricks are given on the Plates.

36. The inscription in Wilkinson MSS, i, 143, (=PM, V, 191) is certainly not from a brick, but may be from a foundation deposit plaque of Sesostri I.

37. Hayes, W.C., *The Scepter of Egypt*, II, 120. Perhaps the stamp No. 17 (PL24) is an error for the latter of these examples.

Two problematical copies have been given³⁸ of a damaged stamp of Amenhotep II, as shown below:

Fig. 95 Copies of Stamp of Amenhotep II.



The problem here is the lacuna at the top of the inscription, where Lepsius wrote *hṯp* (?) and Quibell doubtfully suggested *ḥm*. Recent discoveries suggest that the reading given by Quibell is probably correct, as a similar inscription has been found on re-used bricks of Amenhotep II from the tomb of Tjanuni at Thebes, although in this case the sign  does not occur.³⁹

Brick-stamps continued under Tuthmosis IV and became very elaborate in the reign of Amenhotep III, who added the name of Tiye to some examples. An interesting stamp of this king is number 32 (Plate 26), which is almost certainly from his funerary temple, although it was found re-used at Deir el-Medina. The semi-cryptographic writing deceived Bruyère, who labelled the inscription "inconnu",⁴⁰ and the epithet *mry Sokar* is paralleled in the cartouche on the back of the southernmost of the Memnon Colossi.⁴¹ The inscribed bricks from Malqata show elaboration in the forms of the stamps and have references to the 'House of Rejoicing in the House of Amun'. Two examples of this reign come from Nubia, the only Eighteenth Dynasty stamps so far discovered in that province.

The stamped bricks of the Amarna Period give the names of Akhenaten, Nefertiti and Smenkhkare, as well as the names of buildings at Amarna. A few bricks of Akhenaten have been found at Thebes, mostly loose, or re-used in later structures. A detailed study of all the Amarna bricks has been made by H.W. Fairman in *City of Akhenaten*, II, and the provenance of each type is there given.⁴²

The two inscribed bricks of Ay (59–60) bear the name of his mortuary temple, from which they originally came, before being re-used by Ramesses III at Medinet Habu.

In the Nineteenth Dynasty, there are no known bricks of the ephemeral Ramesses I, but his successor Seti has his name on bricks at Abydos and Amara West. The only other king to possess stamps in this dynasty is Ramesses II, whose bricks occur at Thebes and Matmar. The majority of his Theban bricks originate from the Ramesseum, although later re-use carried them to different areas. The name of the Ramesseum is given as *ḥwt wsr-m3 ct-rc stp-n-rc*, *ḥwt wsr-m3 ct-rc stp-n-rc m pr tmn*, and *ḥwt wsr-m3 ct-rc stp-n-rc ḥnmw w3st*. There are four examples which give the name *wsr-m3 ct-rc* without the epithet *stp-n-rc*; these belong to the period of Ramesses' co-regency with Seti I.

The Twentieth Dynasty, rather inexplicably, has produced not a single stamped brick, not even from the large monuments of Ramesses III. However, the custom re-appears in the Twenty-First Dynasty, and is used both by Psusennes I and the High-Priests Pinudjem and Menkheperre. There is the name of Istemkheb, Leading Lady and Chief of the Harim of Amun, on the bricks of Pinudjem, and another Istemkheb with the same title occurs in the brick-stamps of Menkheperre. These ladies are probably to be identified as Istemkheb A and Istemkheb C, the wives of Pinudjem I and Menkheperre respectively.⁴³

The bricks of Menkheperre are of interest in that they occur not only in temples but also in fortresses at El-Hibeh, Shurafa and Gebelein. Bricks bearing his name from Gebelein have been long known,⁴⁴ but it is not generally recognised that a separate fortress stood on each of the two hills at this point, North of the village of Sheikh Moussa both containing stamped bricks of Menkheperre.⁴⁵

After the Twenty-First Dynasty there are very few examples of royal stamps on bricks, only those of Shabaka and Necho being recorded, apart from an illegible stamp from Medinet Habu. (96) However, some Twenty-Fifth Dynasty examples of the stamps themselves have been discovered, belonging to Shabaka and Shebitku. The Shabaka stamp (94) is made of copper, with a handle on the back, whilst that of Shebitku is of stone, and bears the king's prenomen Djed-ka-ra. (95)⁴⁶ Evidently the stamps could be made of various materials, since another example, in the British Museum, is formed of wood.⁴⁷

38. *L.D.*, III, 62. Quibell, J.E., *The Ramesseum*, Pl. XI.

39. Brack, A., *Das Grab des Tjanuni*, 62-3, Abb. 18 and Pl. 49 c.

40. Bruyère, B., *Deir el-Medineh*, 1934-5, 24.

41. *L.D.T.*, III, 142.

42. Frankfort, H. & Pendlebury, J.D.S., *City of Akhenaten*, II, 150.

43. Kitchen, K.A., *Third Intermediate Period*, 61-5.

44. Gauthier, H., *Livre des Rois*, III, 267.

45. Information kindly supplied by Bernard V. Bothmer.

46. Copies 94-5 (Pl. 36) are derived from these stamps, and are, therefore, positives.

47. B.M. 5993.

In conclusion, it may be said that the custom of impressing royal names on bricks was only consistent in the Eighteenth Dynasty, in which it began, and after that time it declined, despite occasional transitory revivals. The purpose of the custom is not easy to see, except in the case of stamps which give the name of a building; these were intended for use in the building of that name, although they could find their way into other structures.⁴⁸ Bricks bearing only a royal cartouche are more difficult to explain: it cannot signify that they were struck in royal brickyards, otherwise the practice would occur more regularly; probably it is a way of emphasising the king's involvement in the construction of the entire fabric of the building. In this case, like much in Egyptian architecture, it would be a symbolic custom, since the inscription on the bricks would not be visible once they had been built together.

Bricks with Stamps of Private Individuals:

Inscriptions of private persons can occur on the decorative frieze-bricks from Theban tombs⁴⁹ or on ordinary building-bricks, but the former type are by far the commoner. The frieze-bricks are usually stamped with the name and titles of the owner of the tomb, and the inscription is very often identical to that on the funerary cones. In many cases, the stamp occurs several times upon a single brick, normally on the sides and ends, since the inscription was intended to be visible (Plate 37).

The occurrence of private stamps on building-bricks is not common. These bricks are composed of unbaked mud and they bear the inscription on the upper surface, usually surrounded by an oval or rectangular frame. One example, copied by Lepsius, has the name of the owner enclosed in a cartouche, but this may be an epigraphic error⁵⁰ (Plate 38). As in the case of official stamps, the inscriptions on these bricks would be hidden once they had been used for building. The practice of placing stamps of private individuals on bricks probably originated from imitation of the royal inscribed bricks, and it is interesting to note that all the known examples seem to come from Thebes. Although many of these bricks have been found out of their original locations, the style of the inscriptions shows clearly that they were used in tomb-construction. A number of typical stamps are drawn on Plate 38. No private inscribed bricks are earlier in date than the New Kingdom,⁵¹ with the exception of a single brick from the tomb of Nefermaat at Meydum, which bore the name of the owner, roughly inscribed by the finger.⁵² The fact that the inscription was not applied by means of a stamp places this brick in a separate category from those described above.

48. At Amarna, bricks with the stamp *hwr* intended for the Small Temple, were found in the Royal magazines, Priests Quarters and the East block of Government Offices.

49. See above, pp. 140.

50. *L.D.T.*, III, 250.

51. Excluding the ink marks on the bricks in M.K. pyramids.

52. Petrie, W.M.F., *Meydum & Memphis III*, 4 & Pl.XX, 2.

CHAPTER SIXTEEN: BRICK SIZES

The dimensions of Ancient Egyptian bricks have considerable value for dating purposes, provided that they are used intelligently and in conjunction with all the other available architectural evidence. It is not sufficient to take measurements of the bricks in a building and simply assign the structure to a period at which similar sizes occur, since the same size may appear at several different dates. The chronological value of brick sizes was denied by Jéquier, who gave a list of examples to illustrate his argument, but his opinion is invalidated because he has forgotten to convert all his examples to the same system of measurement.¹ The same kind of criticism has been voiced by other archaeologists, because they have expected to find a simple correlation between the dimensions of the bricks and their date, which is not the case. Brick sizes are not only dependent upon date, but also upon the type of building in which the bricks occur. Throughout most of Egyptian history the bricks fall into two groups: (1) Large bricks, used in major public works, and (2) Small bricks, intended for houses and small private tombs. Some overlapping of the use of these two groups occurs, and occasionally the large "official" brick is found in houses, and small bricks in monumental buildings, but the separate use of the two types is fairly consistent. The occurrence of large bricks in ordinary domestic buildings is usually due to their re-use from official structures, an example being the employment of bricks from the royal mortuary temples in private houses at Deir el-Medina.² In this particular case, the official bricks are about 40cm in length, and sometimes bear a royal stamp, whilst the normal domestic bricks are most frequently only 30–33cm long. Difficulties occur when small bricks are found in an official building, since it is impossible to distinguish these from common domestic bricks. The existence of two groups of brick sizes is not apparent in the Archaic Period or in late Roman and Coptic times, when the bricks for all purposes are of small dimensions.

Different groups of sizes can be distinguished by plotting the lengths and breadths on a diagram of the type shown on Plates 41–43. This system was first devised by Petrie,³ and has been used more recently in a study of the bricks at Mirgissa.⁴ Ideally, it is desirable to plot the measurements to an accuracy of millimetres, as Hesse has pointed out,⁵ since this prevents the accumulation of a number of examples at one point. The vast majority of brick sizes recorded from Egypt are only measured to the nearest centimetre, or half-centimetre at best, and until more accurate values are obtained these dimensions have to suffice. Consequently, some of the points plotted in the diagrams on Plates 41–43 represent more than one example. These drawings illustrate the existence of separate groups of sizes, usually distributed along the line where the ratio of the length to the breadth is equal to 2:1. From the Old Kingdom until the Graeco-Roman Period there are both large and small bricks, but the bricks of the Archaic Period form a homogenous group. The graph of brick sizes on Plate 42 shows the variation of both the large "official" bricks and the small "domestic" type from the Old Kingdom until the Coptic Period. Between the two groups there is some overlapping, as shown by the shaded area on the graph, where it is impossible to assign bricks to either class. This kind of graph does not really give a very accurate picture, because the number of available examples varies at different periods, but it does at least show a general trend. Bricks of exceptionally large size, such as the cubit-bricks of the Old Kingdom, have been deliberately excluded from the graph, since they would create a false impression on the basis of a handful of examples. The basic pattern of Egyptian brick sizes is as follows: the bricks of the Archaic Period are all small, then comes an increase in size until the Middle Kingdom, followed by a fluctuation until the Twenty-Sixth Dynasty, after which there is a decrease until modern times. There is chronological value in the variation of the sizes, especially when they are used in conjunction with the information on bonding given in Chapter 14. Brick sizes are also valuable in the study of the monuments of a single ancient site, since they can be used to distinguish those buildings which are contemporaneous, and whether there has been any re-use of the bricks. The great number of brick measurements derived from the tombs of Qau, Matmar and Mostagedda⁶ have been plotted on the diagrams shown in Plates 43–44. Throughout the Old Kingdom and First Intermediate Period, the bricks at all three sites fall within a limited range of size,⁷ but a number of larger bricks appear in the New Kingdom graves at Matmar. Probably these large bricks,

1. Jéquier, G., *Manuel D'Archéologie Egyptienne*, I, 14–5.

2. Bruyère, B., *Deir el-Medineh*, 1934–5, fig.2 & 241–335 *passim*.

3. Petrie, W.M.F., *Bethpelet*, I, 21 & Pls. LXIII.

4. Hesse, A., in Vercoutter, J., *Mirgissa*, I, 102–14.

5. *ibid.*, 104. The use of diagrams of this kind also helps to cancel out errors caused by shrinkage of the bricks.

6. See the Tomb Registers published in Brunton, G., *Qau and Badari*, I–III; *Matmar*, and *Mostagedda*.

7. The exceptional size 25 x 12 x 7cm from a tomb of the First Intermediate Period at Matmar is almost certainly the result of re-use of bricks from an Archaic tomb. See Brunton, G., *Matmar*, 41.

especially those over 38cm in length, were re-used from official buildings in the vicinity. (Bricks in the Temple of Matmar: 45 x 20 x 10cm and 36 x 16 x 8cm) At Qau, the sizes are very much the same at all periods, probably due to extensive re-use of the bricks of the Old Kingdom and First Intermediate graves, and no large bricks comparable to those at Matmar occur. The sizes of the bricks in the Late-Period tombs strongly suggests that they were generally re-used from earlier graves, or, in some cases at Matmar, from the monumental buildings of the New Kingdom. It need hardly be stated that it is most important to detect the re-use of bricks when collecting examples for chronological study.

APPENDIX I: METROLOGY OF EGYPTIAN BRICKWORK

The unit of measurement most frequently employed in the construction of buildings of the Pharaonic period in Egypt was the Royal cubit of twenty-eight digits, a length equivalent to 52.4cm. A considerable amount of deviation from this value occurs in many mud-brick structures, although in certain buildings the dimensions can be extremely accurate, as in the pyramid of Sesostri III at Dashur, the sides of which measure 200 cubits of 52.45cm.¹ A good example of the range of variation in the value of the cubit is afforded by the different lengths of the four sides of the enclosure wall around the mastaba of Idi at Dara,² all of which were intended to be 100 cubits:

North side	52.55m
East side	53.32m
South side	58.40
West side	51.10m

In the list below, a number of inductions are stated, derived from various buildings, to illustrate further the different standards of accuracy which occur.

Location	Metric	Cubits	Value (cm)
Naqada mastaba	53.16 x 26.1	100 x 50	53.16, 52.20
Saqqara tomb 3035	57.3 x 26.0	110 x 50	52.1, 52.0
Saqqara tomb 3506	47.55 x 19.55	90 x 37	52.8, 52.8
Saqqara tomb 3500	31.75 x 15.85	60 x 30	52.8, 52.8
Pyramid of Sesostri III, Dashur	104.9 x 104.9	200 x 200	52.45, 52.45
'Edifice M,' Dara	130 x 130	250 x 250	52.0, 52.0
Enclosure of South Pyramid, Mazghuneh.			
North	77.8	145	53.6
East	76.4	145	52.6
West & South	76.6	145	52.8
Thebes: Stores of Merenptah			
Funerary temple	15.5	30	51.7
	20.9	40	52.25
	10.6	20	53.0
	10.84	20	54.2
Thebes: Ramesseum storehouses	3.2	6	53.3
	3.7	7	52.8

The metrology of the panelled mastabas of the Archaic Period is interesting, but satisfactory inductions cannot always be obtained for the dimensions of the various buttresses and recesses. There are difficulties caused by errors and approximations in the ancient construction and in the modern measurements. Mastaba V at Giza had niches 1.83m wide, separated by buttresses 2.73m across, which Petrie considered to be 100 and 150 true digits respectively.³ However, a length of 3½ cubits could also be a possibility for the width of the niches. The Naqada mastaba of Neithhotep is intended to be 100 x 50 cubits in size, the values of the cubit being 53.03–53.28cm and 52.25cm. Some of the internal chambers also suggest cubit measurements: the burial chamber is 14 x 12 cubits, and several of the magazines are 5 x 8½ cubits. (Value of cubit = 52.6 and 52.4cm) Borchardt took the total width of the main niche plus the buttress to be 7½ cubits,⁴ but this does not agree well with the overall size of the tomb. It seems that the widths of the individual niches and buttresses on the long sides of this tomb were not the same as on the ends, since the ratio between the length and breadth is 1:2, but the ratio between the number of niches on the long and short sides is 13:6.

1. De Morgan, J., *Fouilles à Dachour, Mars-Juin, 1894*, 47.
 2. Weill, R. & Pillet, M., *Dara*, 114.
 3. Petrie, W.M.F., *Gizeh and Rifeh*, 6.
 4. Borchardt, L., *ZAS* 36 (1898), 104-5 and Pls. XIV-XVI.

The intended size of the component parts of the palace-facade can be deduced from the total size of the mastaba by means of a simultaneous equation, in which x = the length of the large niche + that of the buttress and y = the length of the buttress alone. This method not only shows the theoretical size, but also reveals errors in ancient or modern measurements, since the results can disagree with the published dimensions of the monuments. The examples below illustrate the method of calculation.

Example 1: Saqqara Tomb 3038.

Size of mastaba = 36.9 x 13.8m (mean values)
= 70 x 26 cubits.

Let x = length of Recess + Buttress.

Let y = length of Buttress alone.

The mastaba has 9 recesses on the long sides, and 3 on the short.

Therefore $9x + y = 70$

$3x + y = 26$

Subtract $6x = 44$ Therefore $x = 44 = 7 \frac{1}{3}$ rd cubits.
6

Substitute for y : $66 + y = 70$

$22 + y = 26$ Therefore $y = 4$ cubits.

The buttress is 4 cubits wide, the recess $7 \frac{1}{3}$ rd - 4 = $3 \frac{1}{3}$ rd cubits.

These results agree well with the observed measurements of the facade. ($3 \frac{1}{3}$ rd cubits for 1.75m, value of cubit = 52.5cm.)

Example 2: Saqqara Tomb 3035.

Size of mastaba = 57.3 x 26m = 110 x 50 cubits.

The mastaba has 14 recesses on the long sides and 6 on the short.

Therefore $14x + y = 110$

$6x + y = 50$

Subtract $8x = 60$ Therefore $x = 60 = 7 \frac{1}{2}$ cubits.
8

Substitute for y : $105 + y = 110$

$45 + y = 50$ Therefore $y = 5$ cubits.

The buttress is 5 cubits wide, the recess $7 \frac{1}{2} - 5 = 2 \frac{1}{2}$ cubits.

The results in this case are in disagreement with Emery's measurements⁵ which allow 2.25m for the buttress and 1.60m for the recess. This kind of discrepancy frequently arises when the lengths of the panelling are analysed in this way, as the equation gives the theoretical, ideal dimensions, whereas the sizes of the niches on the monuments themselves were almost certainly not entirely regular, and were, to some extent, influenced by the sizes of the bricks. In those tombs in which the dimensions of the panelling on the long sides differ from those along the ends, such as the Naqada tomb, or the mastabas at Tarkhan,⁶ the equation cannot be applied, since it merely leads to an impossible result.

The determination of the intended size of individual bricks is even more difficult than the metrology of the palace-facade, and it seems that most Egyptian bricks were not made to any standard size, but only within a general range of dimensions which varied with date. Only the cubit-bricks of the Old Kingdom show clearly that they were made to a fixed size, being one cubit long and half a cubit across.⁷ (52-53 x 26cm) These bricks also occur in columns, in which case they are a cubit square.⁸ It is virtually impossible to say anything definite about the sizes of other bricks; the very common dimensions of 30 x 15cm in domestic architecture may be 4 x 2 palms, which is the sort of format one would expect to find in such buildings, but this is no more than a tentative supposition.⁹

5. Emery, W.B., *The Tomb of Hemaka*, 3.

6. Petrie, W.M.F., *Tarkhan*, II, 4 & Pl. XVIII.

7. Petrie, W.M.F., *Naqada and Ballas*, 66. Quibell, J.E. & Hayter, A.G.K., *Teti Pyramid, North Side*, 17, 19.

8. *ibid.*, 20.

9. On the difficulties of evaluating brick sizes, see Mond, R. & Myers, O.H., *The Bucheum*, I, 48-9.

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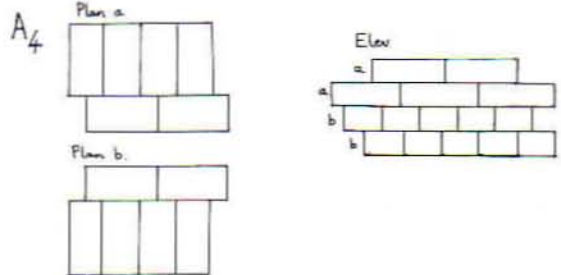
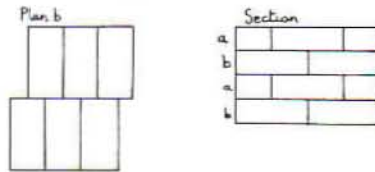
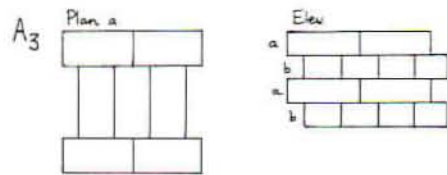
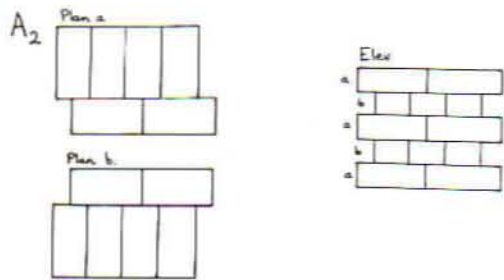
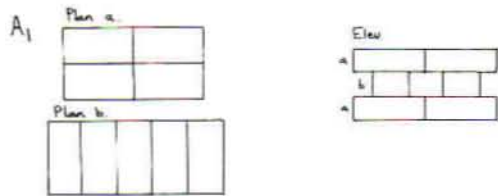


Plate 3

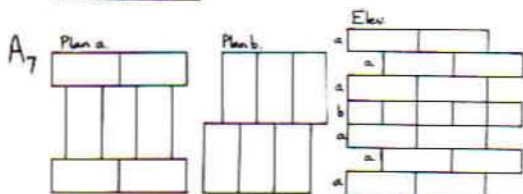
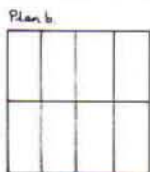
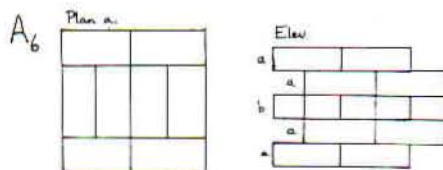
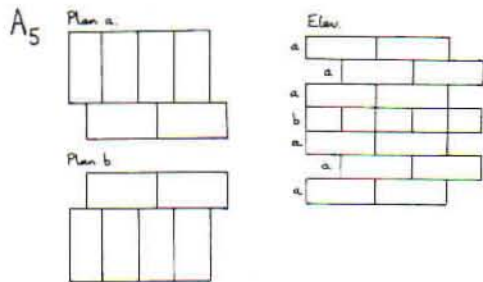
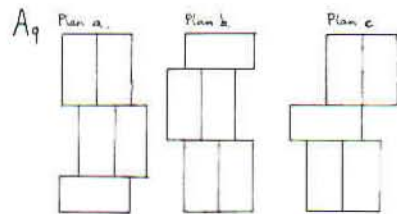
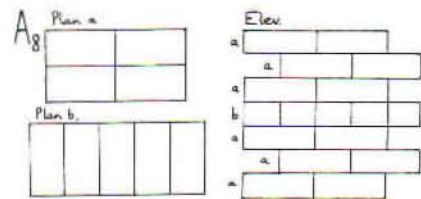
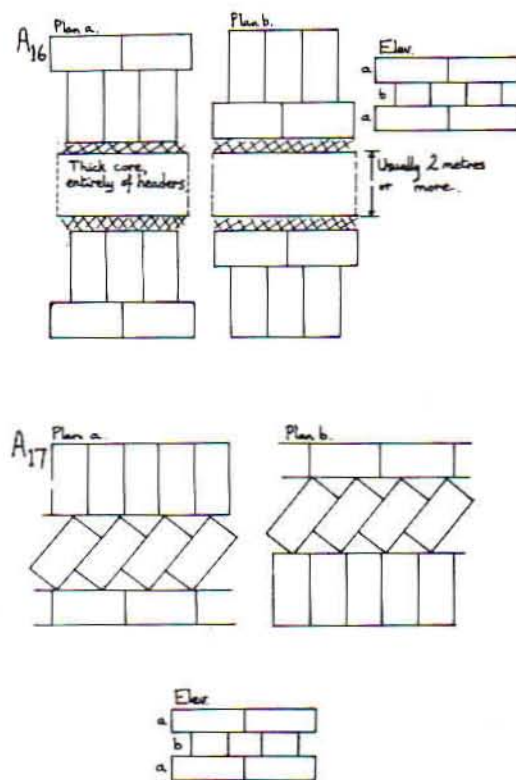
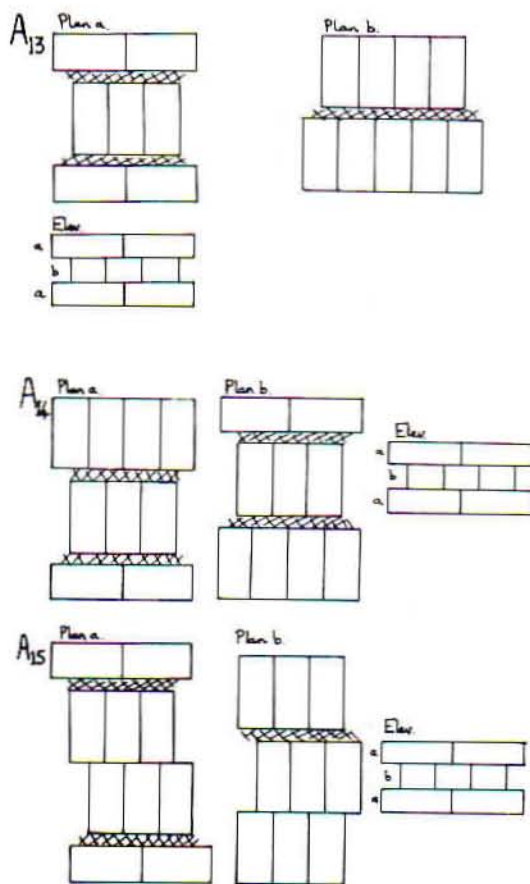
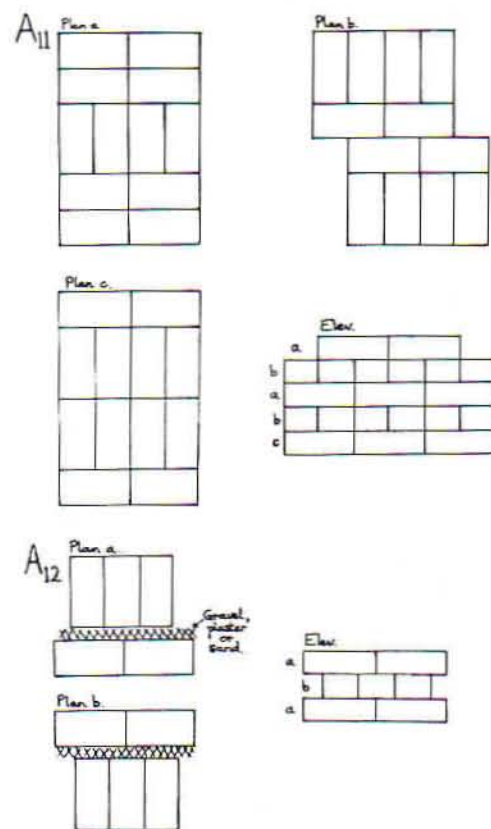
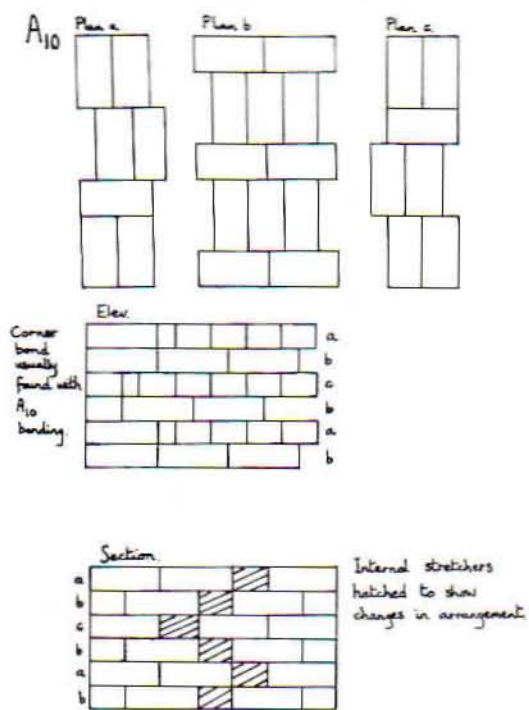


Plate 4





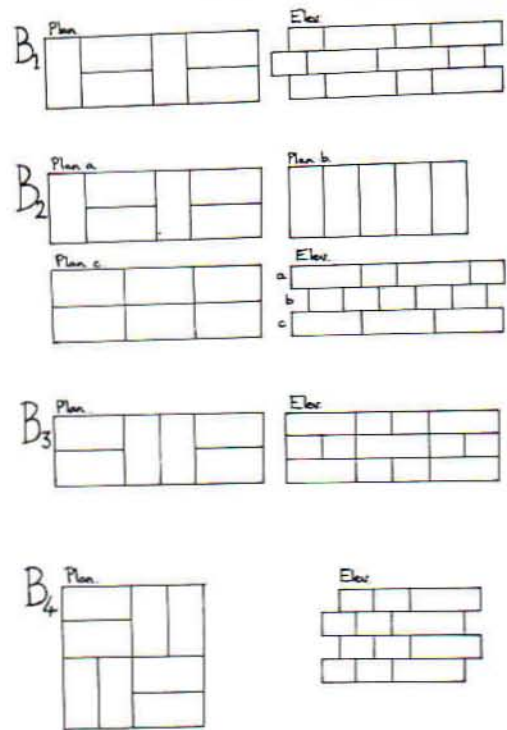
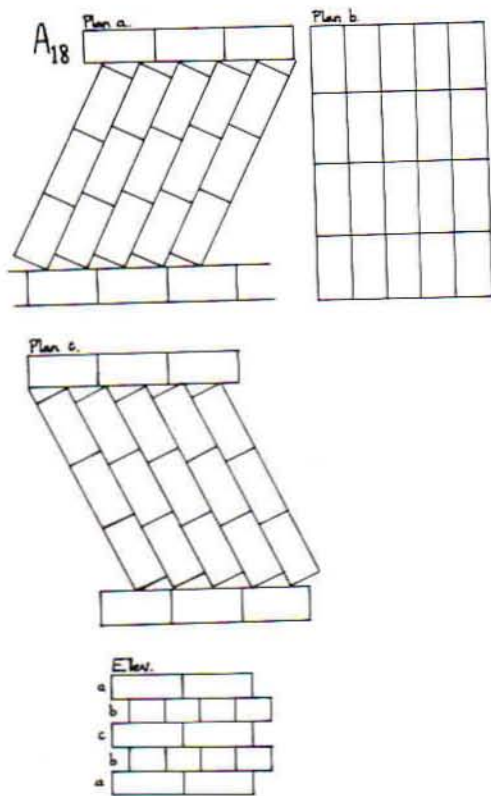


Plate 11

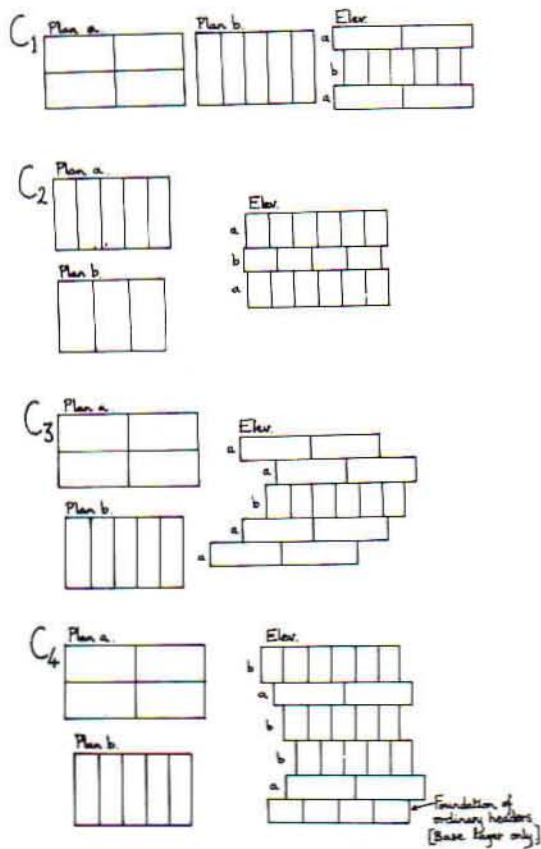


Plate 12

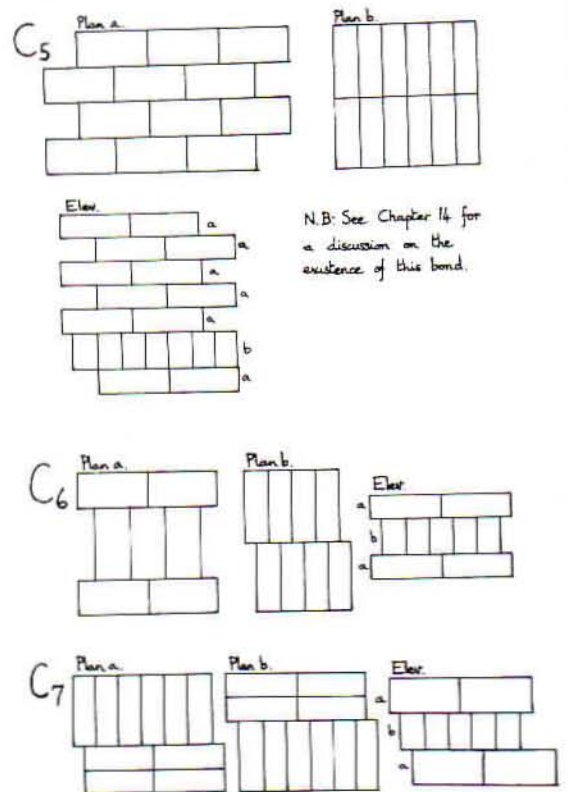


Plate 13

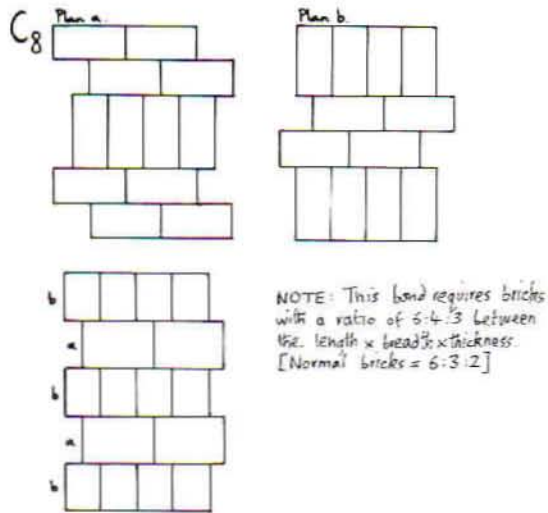
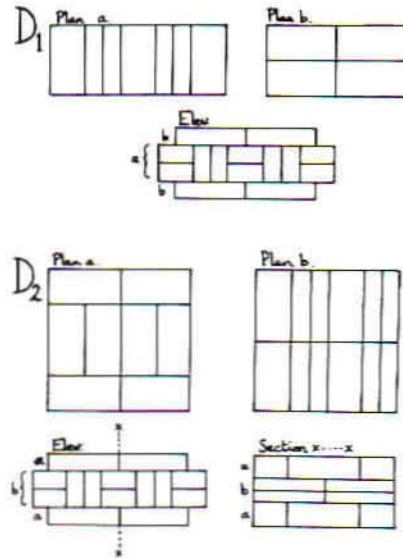
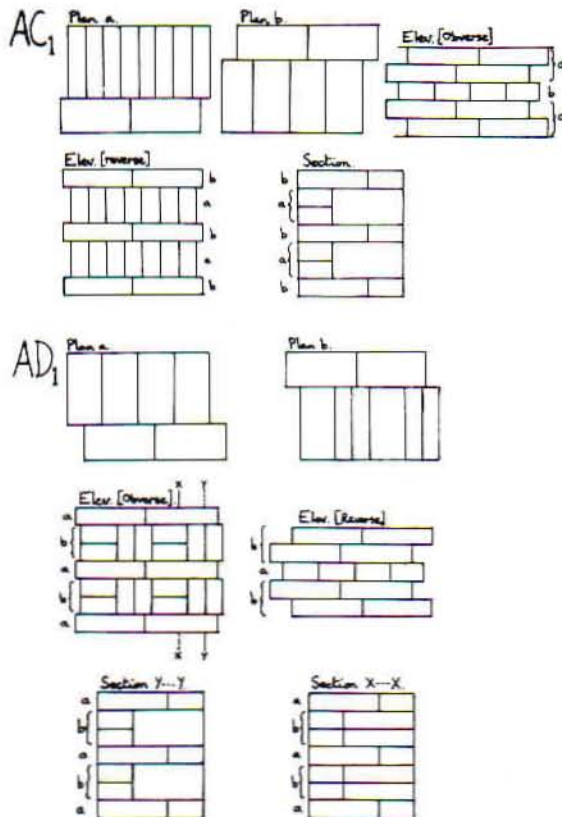


Plate 14



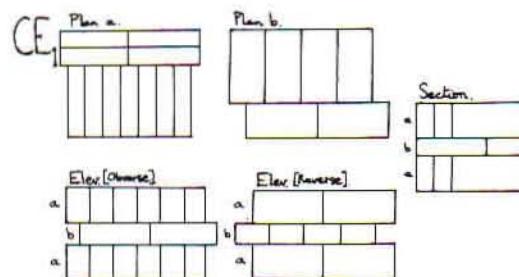
For the above two bonds, the proportions of the bricks have to be such that the ratio of length: breadth: thickness = 6:3:1½. [Normal brick = 6:3:2]

Plate 15

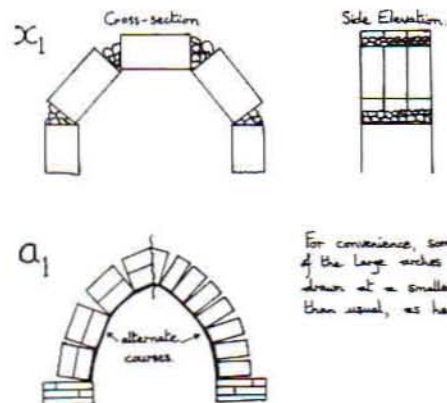


Bonds AC₁ and AD₁ require bricks where the ratio of length: breadth: thickness = 6:3:1½. [Normal bricks = 6:3:2]

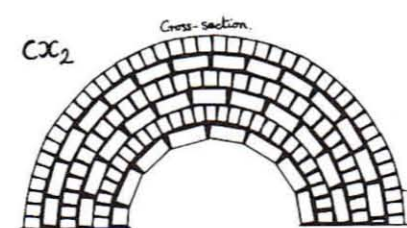
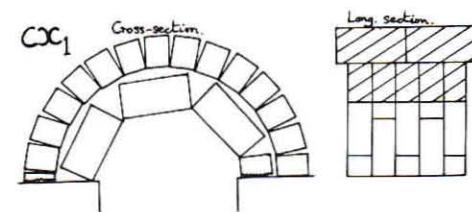
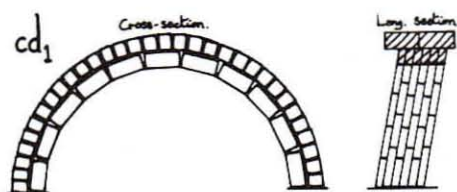
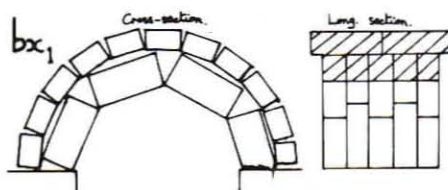
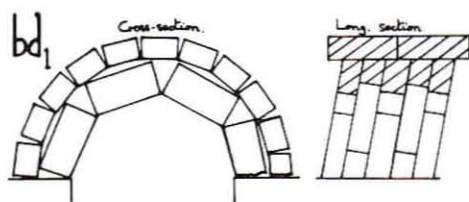
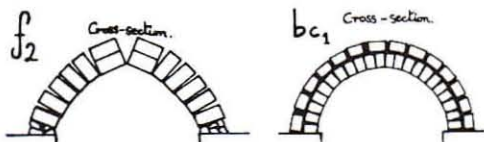
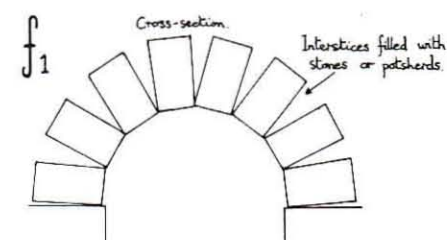
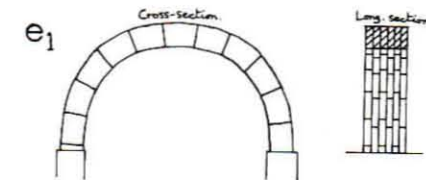
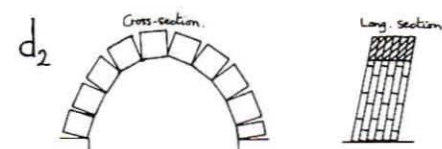
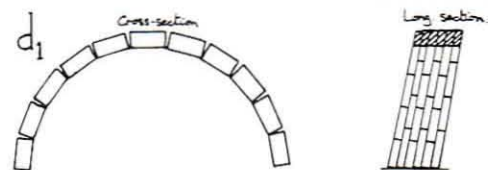
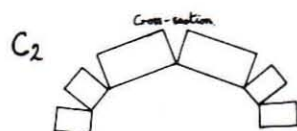
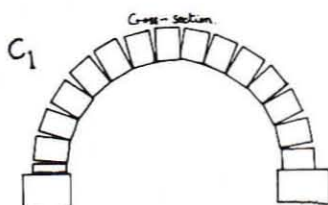
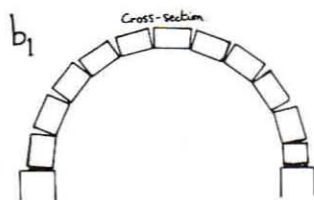
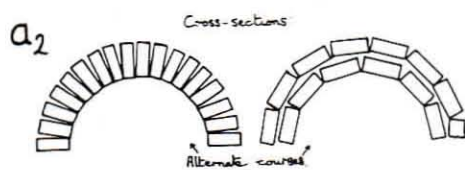
Plate 16



Arches and Vaults



For convenience, some of the large arches are drawn at a smaller scale than usual, as here.





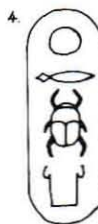
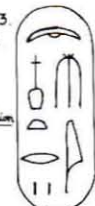
Cenotaph and Temples
at Abydos.

Randall-Melver and Mace,
EL-Amrah and Abydos, Pl. XXXII.



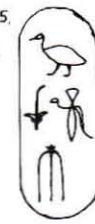
Thebes: Deir-el-Bahari
chapel.

Carter, Five Years Exploration
at Thebes, Pl. XXVIII.



Thebes: Deir al-Medina.

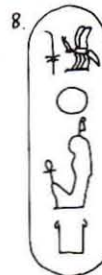
Brugère, Deir al-Medineh,
1934-5, fig. 2.



Thebes: Valley Temple
of Hatshepsut.
Tutmosis III Funerary
Temple (re-use)
L.D. III, 26.
Carter, *op. cit.*, Pl. XXXII.

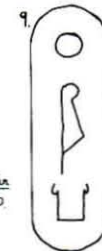


Thebes: Small Temple
of Medinet Habu.
E.M.H., II, 7(a)
Also in Diva abul Naga
tombs (re-use)
Chassinat, E., BIFAO 10
(1912), 167.



Thebes: Valley Temple
of Hatshepsut.

Northampton, Excavations in
the Theban Necropolis 40.

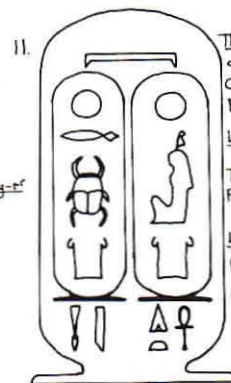


Thebes: Valley Temple
of Hatshepsut.

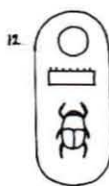
L.D. III, 25a-26.



Thebes: Valley Temple
of Hatshepsut.
L.D. III, 26.
variant with epithet *my-rr*
- L.D.T. III, 140.

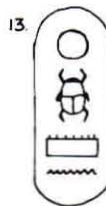


Thebes: Valley Temple
of Hatshepsut.
Carter, *op. cit.*,
Pl. XXXII.
L.D. III, 26.
Tutmosis III
Funerary Temple (re-use)
L.D.T. III, 126.
Weigall, ASAE 7
(1906), 129.



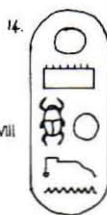
Thebes: Deir al-Medina (re-use)
Brugère, Deir al-Medineh, 1934-5 fig. 2
Medinet Habu (re-use).
E.M.H., II, 7(a)
Gurna Tombs
Mond, R., ASAE 6 (1905), 73
Nagada
Dandoy, G., Rec. Trav., 16 (1894), 44.

The Funerary Temple of Tutmosis III:
Ricke, H., Der Totentempel Tutmoses' III, 34.

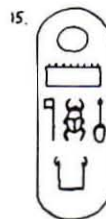


Gurna

Brunton, G., Gurna, Pl. XLVIII.

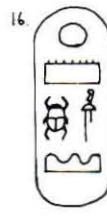


Thebes:
Medinet Habu (re-use).
E.M.H., II, 7(b)



Thebes: Funerary Temple
of Tutmosis III.

L.D. III, 39
Ricke, H., *op. cit.*, 34.



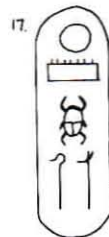
Thebes: Deir el-Bahari.

Debnun-Smekhala, E., ASAE 60
(1968), 130 + Pl. XXXVI.



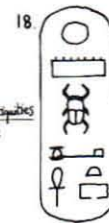
Thebes: Funerary Temple of Tutmosis III.

All in Ricke, H., Der Totentempel Tutmoses' III, 34-36.



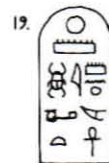
Hilton-Price Collection.

Catalogue of Egyptian Antiquities
in the Collection of F. G.
Hilton-Price, 222.
sic.



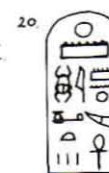
Thebes: Funerary Temple
of Tutmosis III
Ramesseum (re-use)

L.D. III, 39.



Thebes: Funerary
Temple of Tutmosis III.

L.D. III, 39.

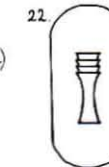


Thebes: Funerary Temple
of Tutmosis III.

L.D. III, 39.

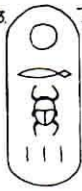
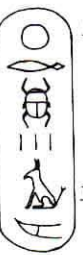


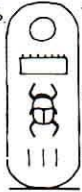
Thebes:
Medinet Habu (re-use).
E.M.H., II, 7(d)



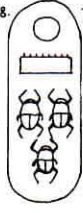
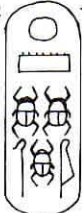
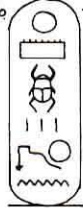
Thebes: Funerary Temple
of Tutmosis III.

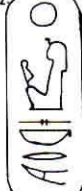
L.D.T. III, 126.

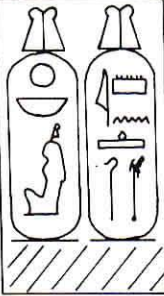
23. Thebes: Ramesseum (re-use)
Gurna Tombs (re-use)

L.D., III, 62
24. Naqada:

Dareddy, G., *Rec Trav*, 16 (1894), 44
25. Thebes: Colonnaded Temple of Rameses IV. (re-use)
Northampton, *Excavations in the Theban Necropolis*, 40

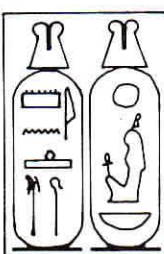
Variant with reversed cartouches, Theban Tomb 158 (re-use)
(Philadelphia Univ. Mus. 29.86.711 and 29.87.620-1.)
See also Chassinat, E., *BIFAO*, 10 (1912), 167
Variant with atef-plumes: L.D.T., III, 240
26. Thebes: Gurna (re-use)

Mond, R., *BSAE* 6 (1905), 69
L.D.T., III, 139.
27. Thebes: Deir el-Medina.

Bruyère, *op. cit.*, fig. 2

28. Thebes: Mortuary Temple of Tutmosis IV.

L.D., III, 69.
Variant with atef-plumes re-used at the Ramesseum.
L.D.T., III, 138.
29. Thebes: Mortuary Temple of Tutmosis IV.
Medinet Habu (re-use).

L.D., III, 69.
E.M.H., II, 7(e).
30. Thebes: Mortuary chapels of Dyn. 18. west of the Ramesseum.

Anthes, R., *MDIK*, 12 (1943), 15.
31. Thebes: Malgata.
Medinet Habu (re-use).

Hayes, W.C., *JNES* 10 (1951), fig. 30, V.
E.M.H., II, 7(f).
Perhaps also at Qau.
Petrie, W.M.F., *Antaeopolis*, 16.
32. Thebes: Deir el-Medina (re-use).

Bruyère, *op. cit.*, fig. 2.

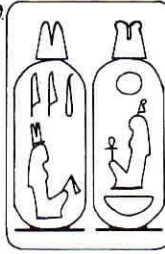
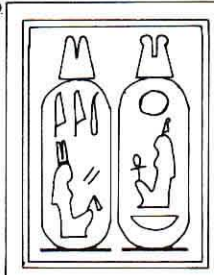
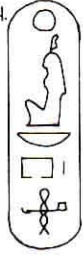
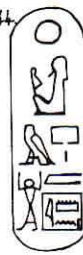
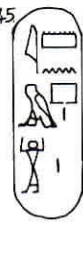
33. Thebes: Kom el-Heitan.

L.D.T., III, 147.
34. Thebes: Malgata.

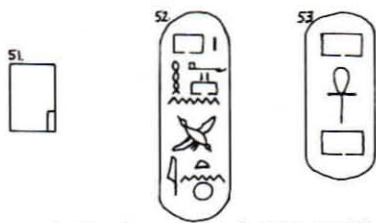
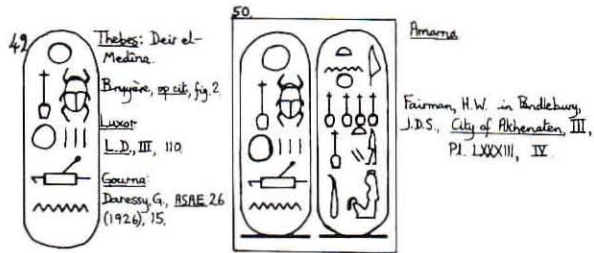
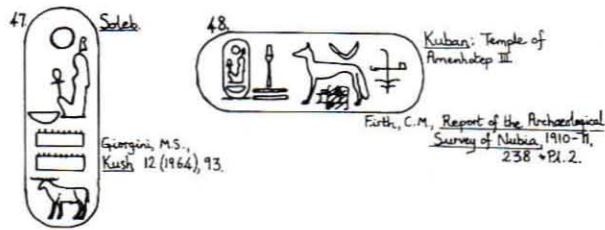
L.D., III, 78.
35. Thebes: Malgata.

Hayes, *op. cit.*, fig. 30, I.
36. Thebes: Malgata.

Hayes, *op. cit.*, fig. 30, II.
37. Thebes: Deir el-Medina.

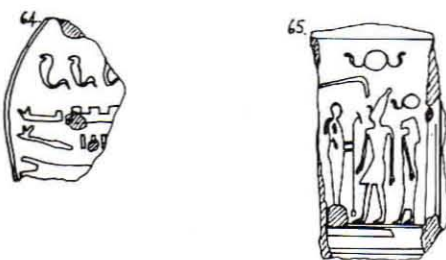
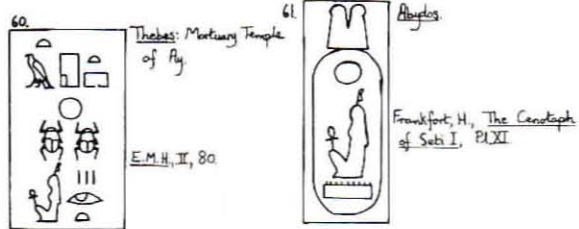
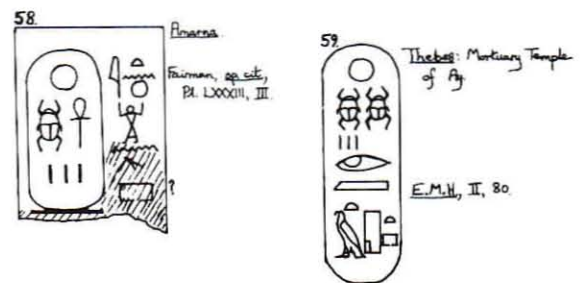
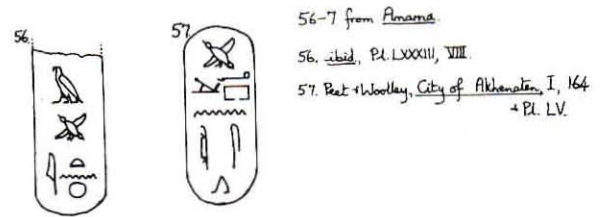
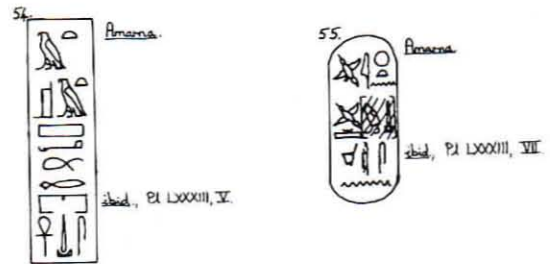
Bruyère, *op. cit.*, fig. 2.
38. Thebes: Malgata.

L.D.T., III, 185.

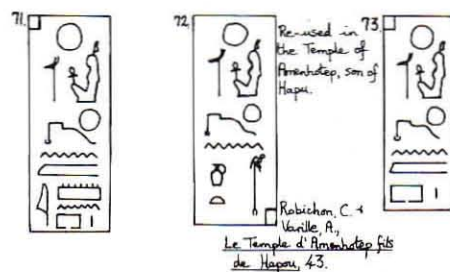
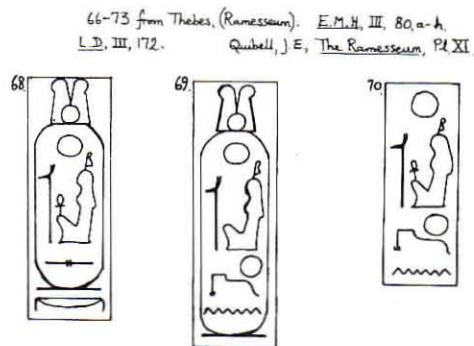
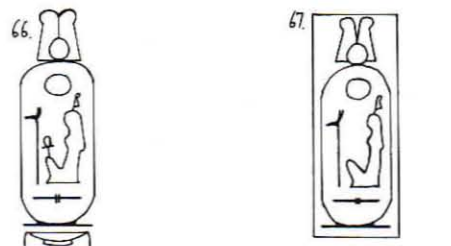
39. Thebes: Malgata.

Hayes, *op. cit.*, fig. 30, IV.
40. Thebes: Malgata.

Hayes, *op. cit.*, fig. 30, III.
41. 
42. 
43. 41-3 from Thebes (Malgata).
Hayes, *op. cit.*, fig. 30, VI-VII
also L.D., III, 78.
43 re-used at Medinet Habu.
E.M.H., II, 7(g).
44. 
45. 
46. 44-6 from Thebes (Malgata).
Hayes, *op. cit.*, fig. 30, VIII-X.

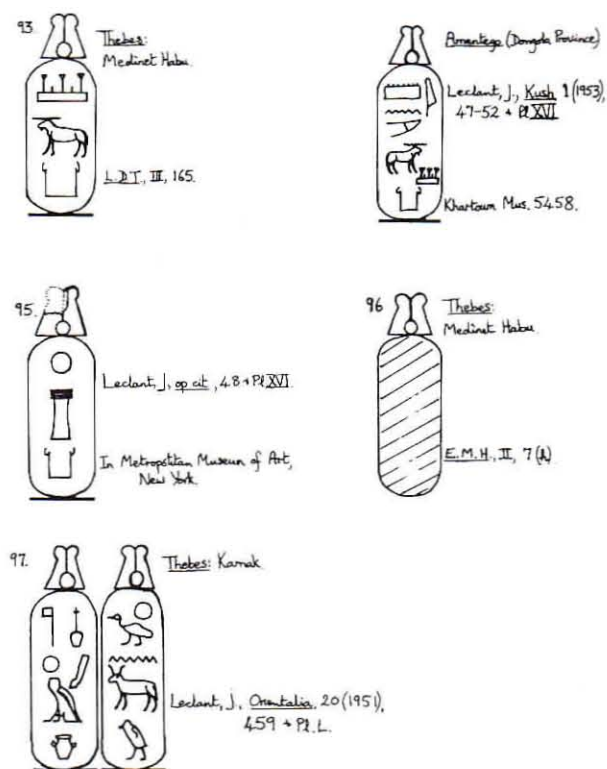
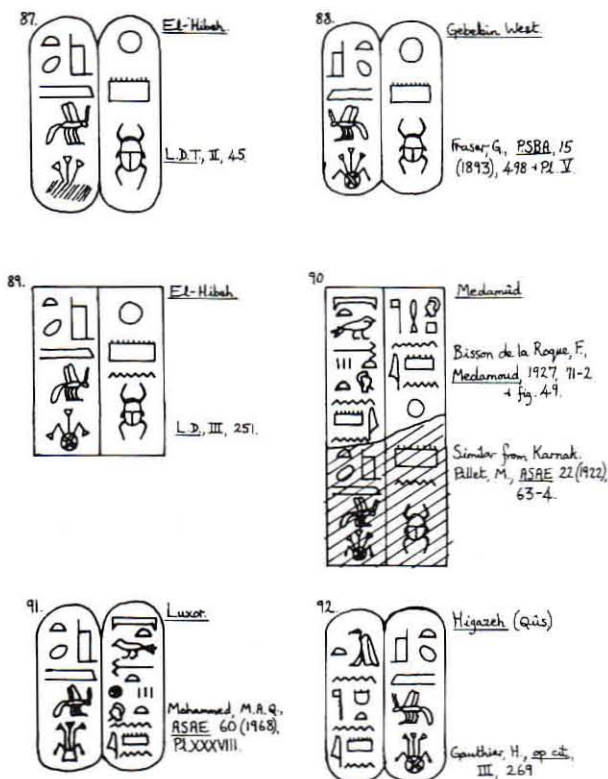
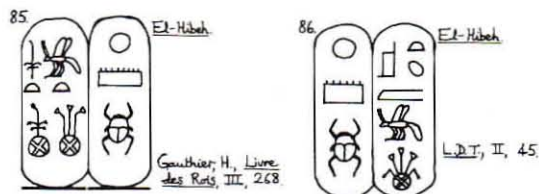
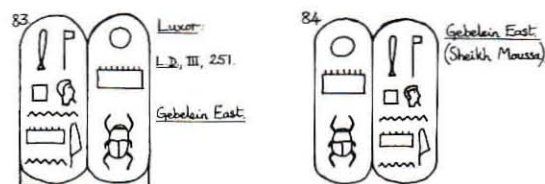
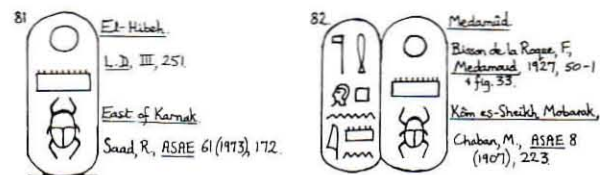
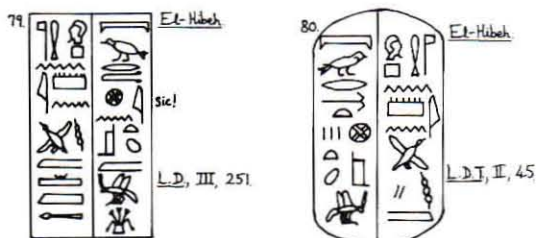
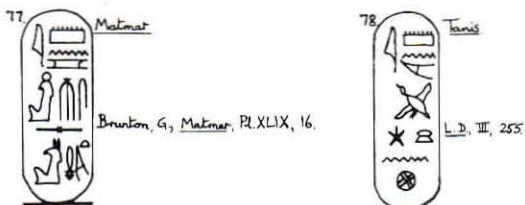
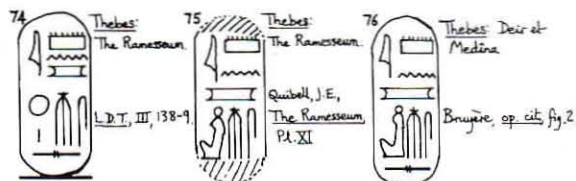


51-3 from Amarna: *ibid.*, Pl. LXXXIII, I, II, VI.

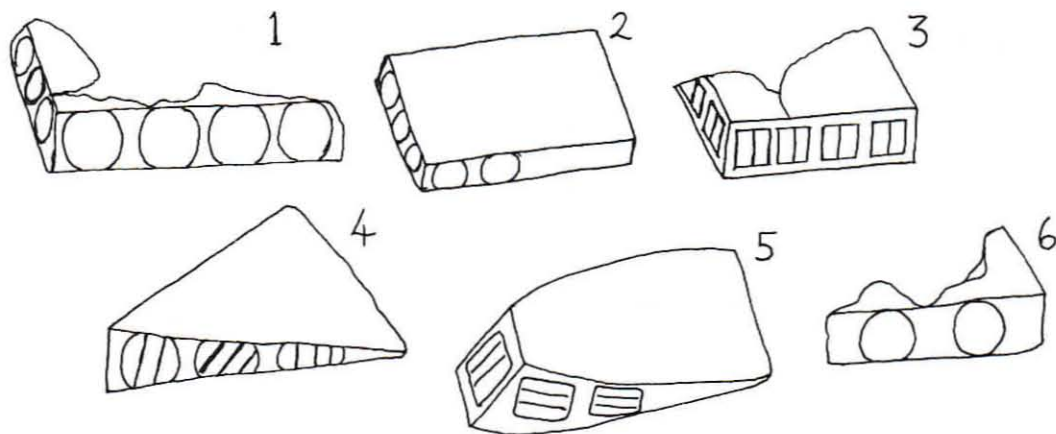


62-5 from Amarna West (unpublished)





FRIEZE BRICKS

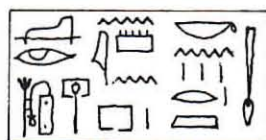


EXAMPLES OF INSCRIPTIONS ON FRIEZE BRICKS



Thebes: Tomb 157.

L. D. I, 239.



Thebes: Tomb 178.

Borchardt, et al., ZAS 70 (1934), 26.



Thebes: Tomb of Nakht. (52).

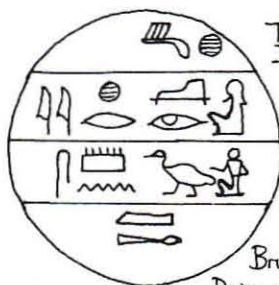
On brick of type 5.

Davies, N. de G., The Tomb of Nakht at Thebes, 42.



Thebes: Tomb of Serimen.

L. D., III, 25a.



Thebes: Tomb 1089, Deir el-Medina.

On brick of type 4.

Bruyère, B., Deir el-Medineh, 1926, 55.

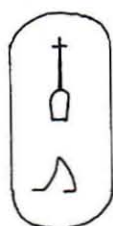


Thebes: Tomb of Senmut.

On bricks of type 6.

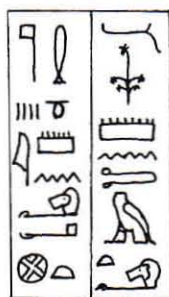
L. D., III, 25a.

EXAMPLES OF PRIVATE STAMPS ON MUD BRICKS



Thebes: Ramesseum. (re-use).

Quibell, J.E., *The Ramesseum*, Pl. XI.



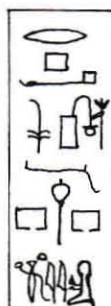
Thebes: Tomb 34.

Ledant, J., *Montouemhat*, 155.



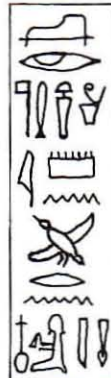
Thebes: Tomb C.1. (Khokha).

L.D.T., III, 250.



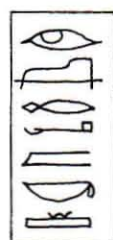
Thebes: Near colonnaded temple of Ramesses IV.

Northampton, *Excavations in the Theban Necropolis*, 40.



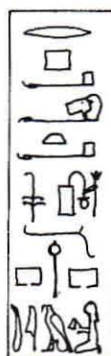
Thebes: Dira' abu'l Naga.

L.D.T., III, 239.



Thebes: Deir el-Medina.

Bruyère, B., *Deir el-Medineh*, 1934-5, fig. 2.



Thebes: Near colonnaded temple of Ramesses IV.

Northampton, *op. cit.*, 40.



Thebes: Deir el-Medina.

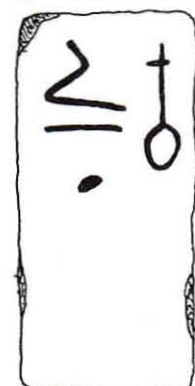
Bruyère, *op. cit.*, fig. 2.



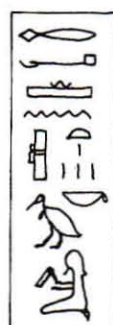
Thebes: Dira' abu'l Naga.

Gauthier, H., *BIFAO* 6 (1908), 142.

INSCRIBED BRICK OF NEFERMAAT.



Meydum

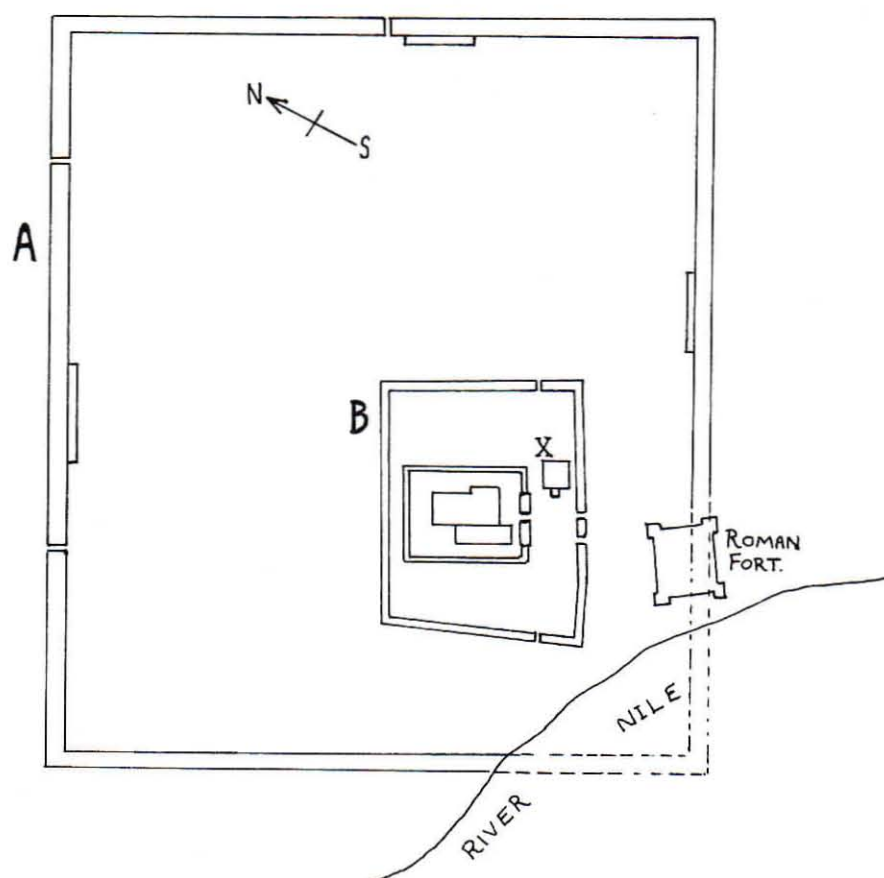


Thebes: Deir el-Medina.

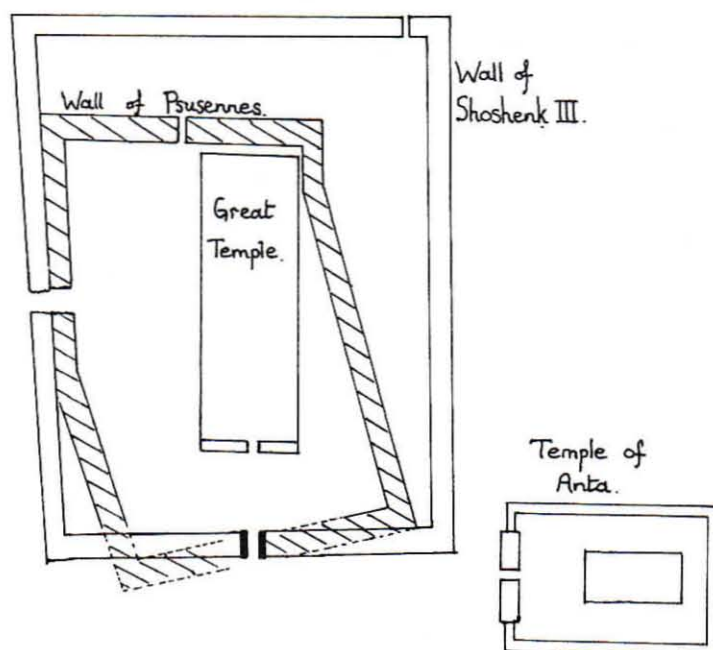
Bruyère, *op. cit.*, fig. 2.

Petrie, W.M.F. + Wainwright, G., *Meydum and Memphis III*, Pl. XX, 2.

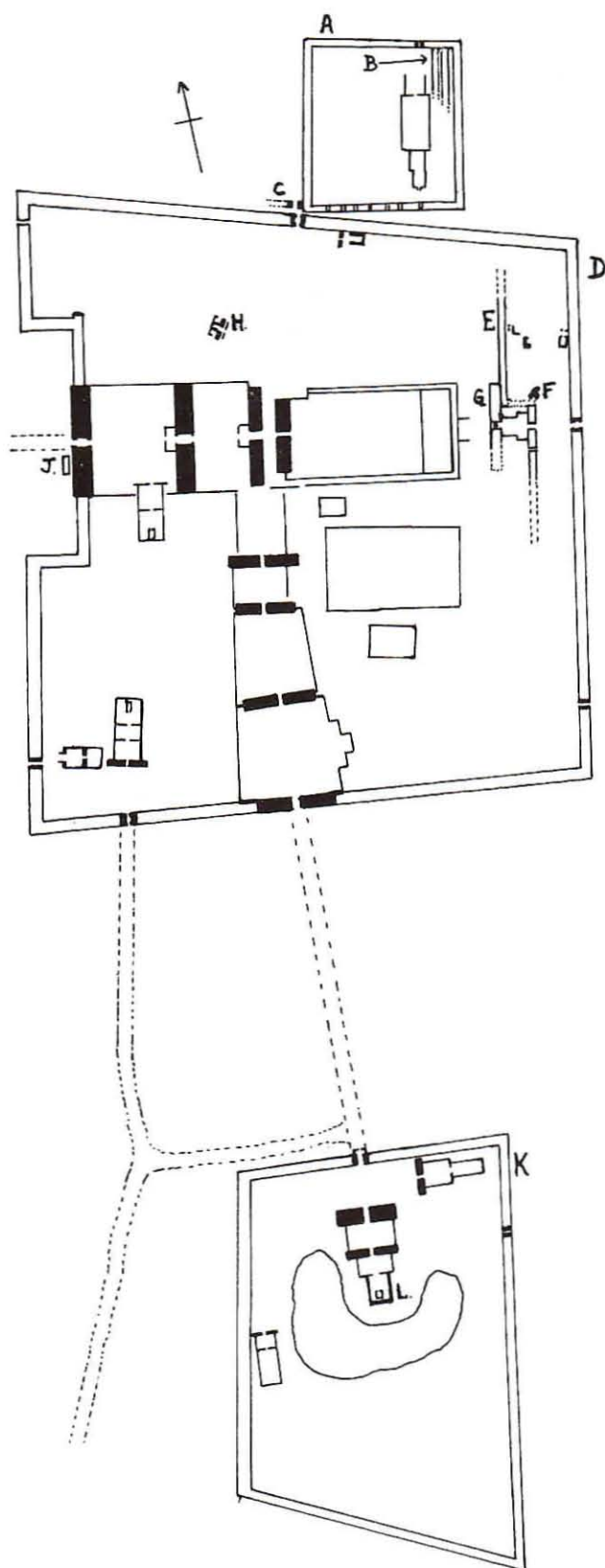
EL KAB: TEMPLE ENCLOSURE



TANIS: TEMPLE ENCLOSURE



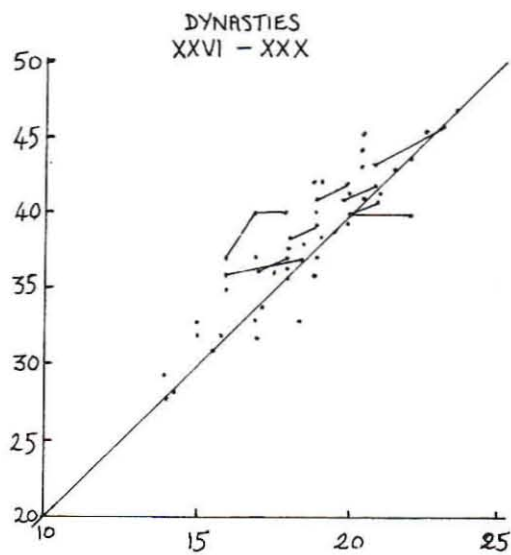
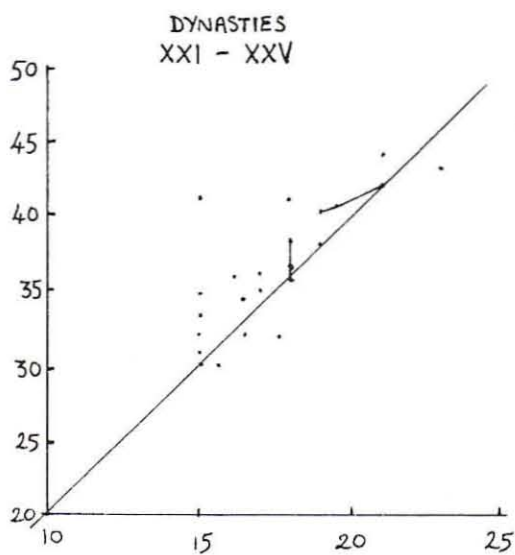
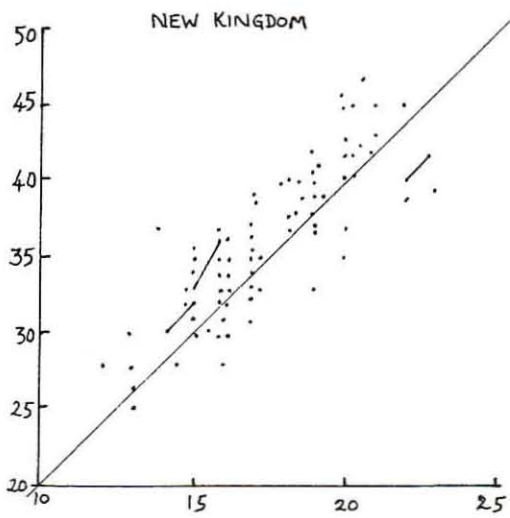
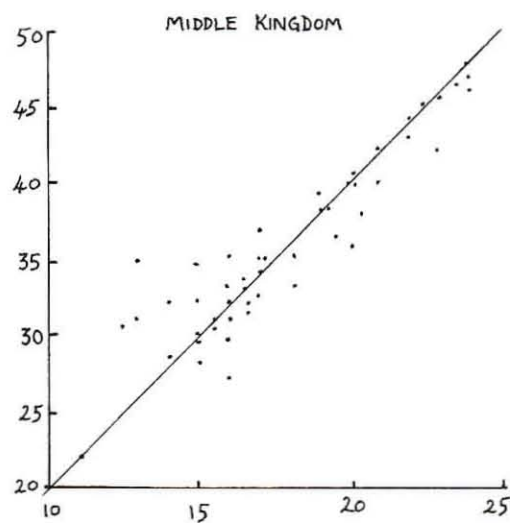
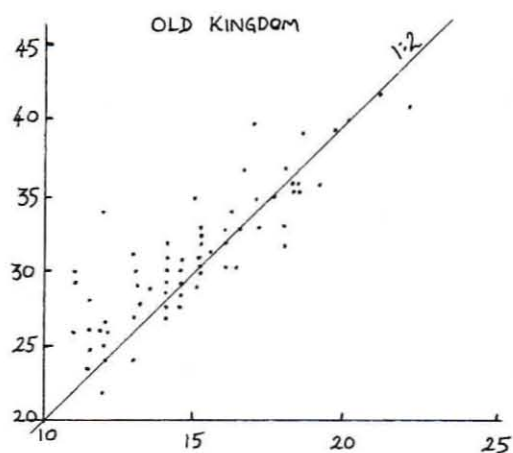
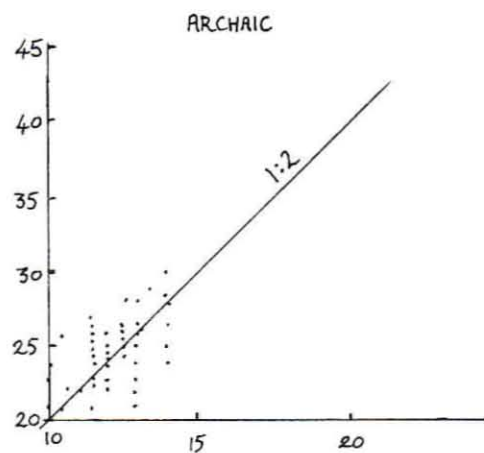
KARNAK: GENERAL PLAN



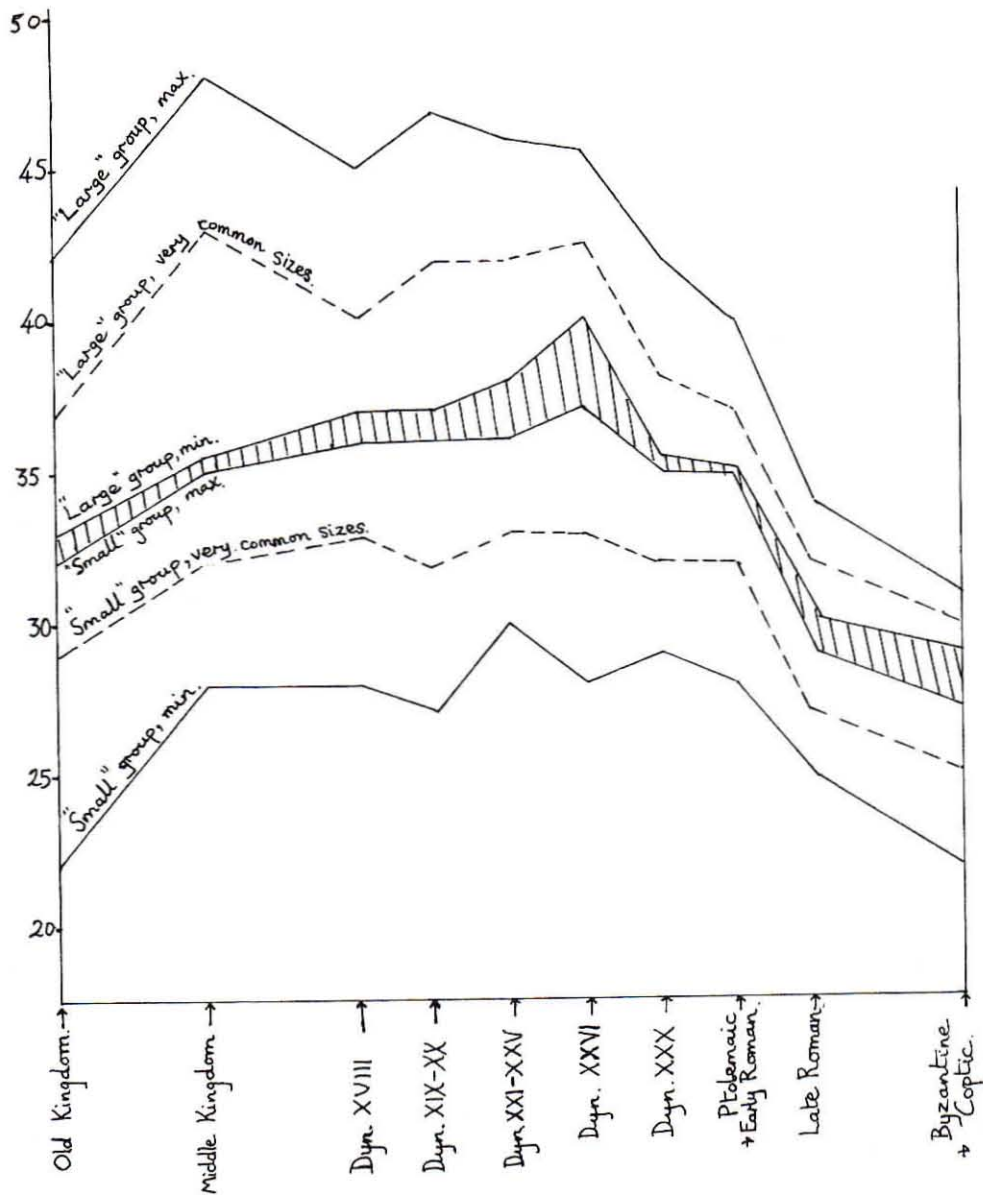
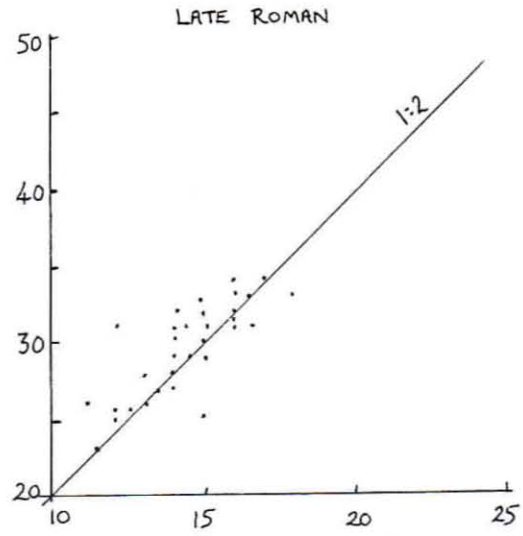
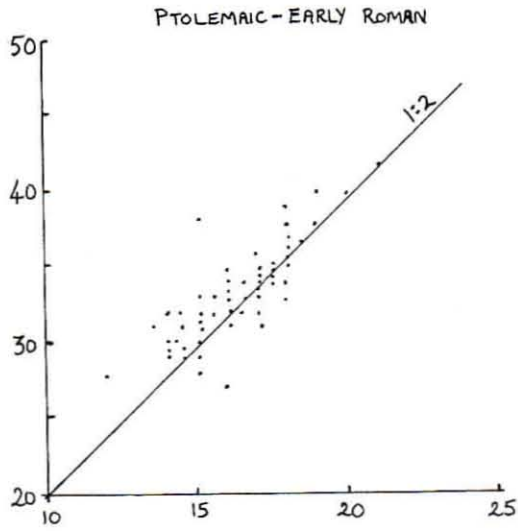
Reference:

- A. Latest enclosure, Montu temple.
- B. Remains of walls of Dyn.18. and later.
- C. Part of Late-Period wall of Montu temple.
- D. Great enclosure wall of Nectanebo I.
- E. Earlier wall around Amun temple, Dyn.25 (?)
- F. Burnt-brick structure of Necho II.
- G. Roman mud-brick wall.
- H. Chapel of Amasis & Nitocris.
- J. Roman chapel.
- K. Enclosure-wall of Mut temple, Ptolemaic.
- L. Burnt-brick wall near sanctuary of Mût temple.

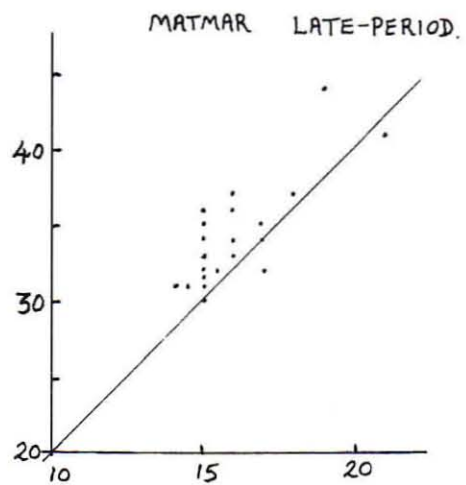
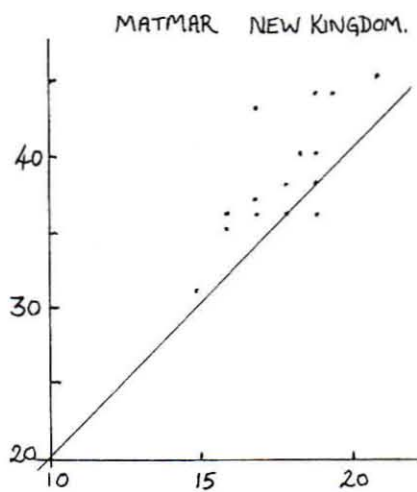
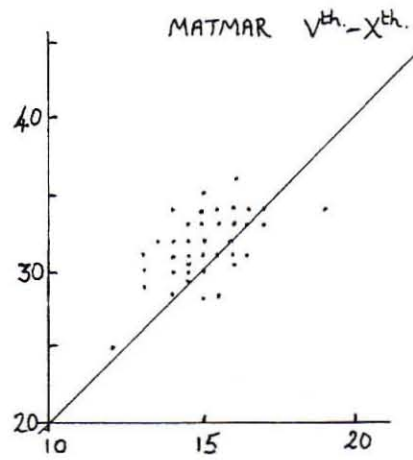
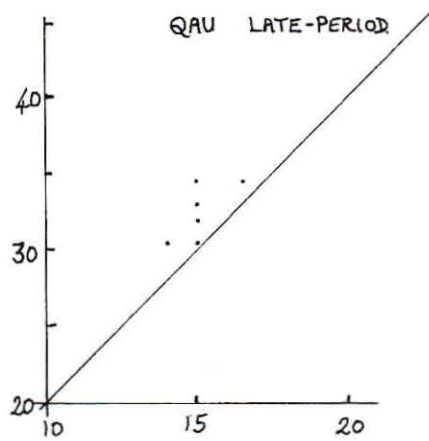
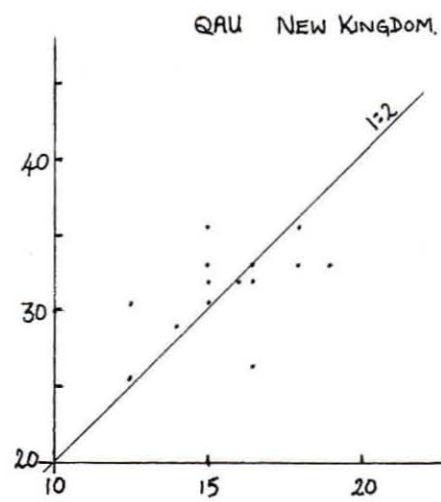
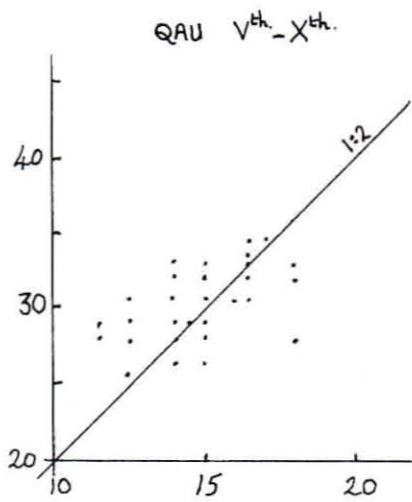
BRICK SIZES



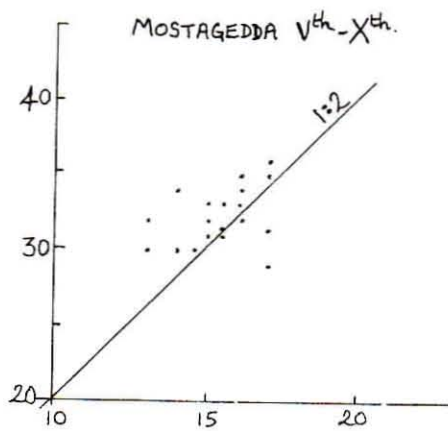
BRICK SIZES



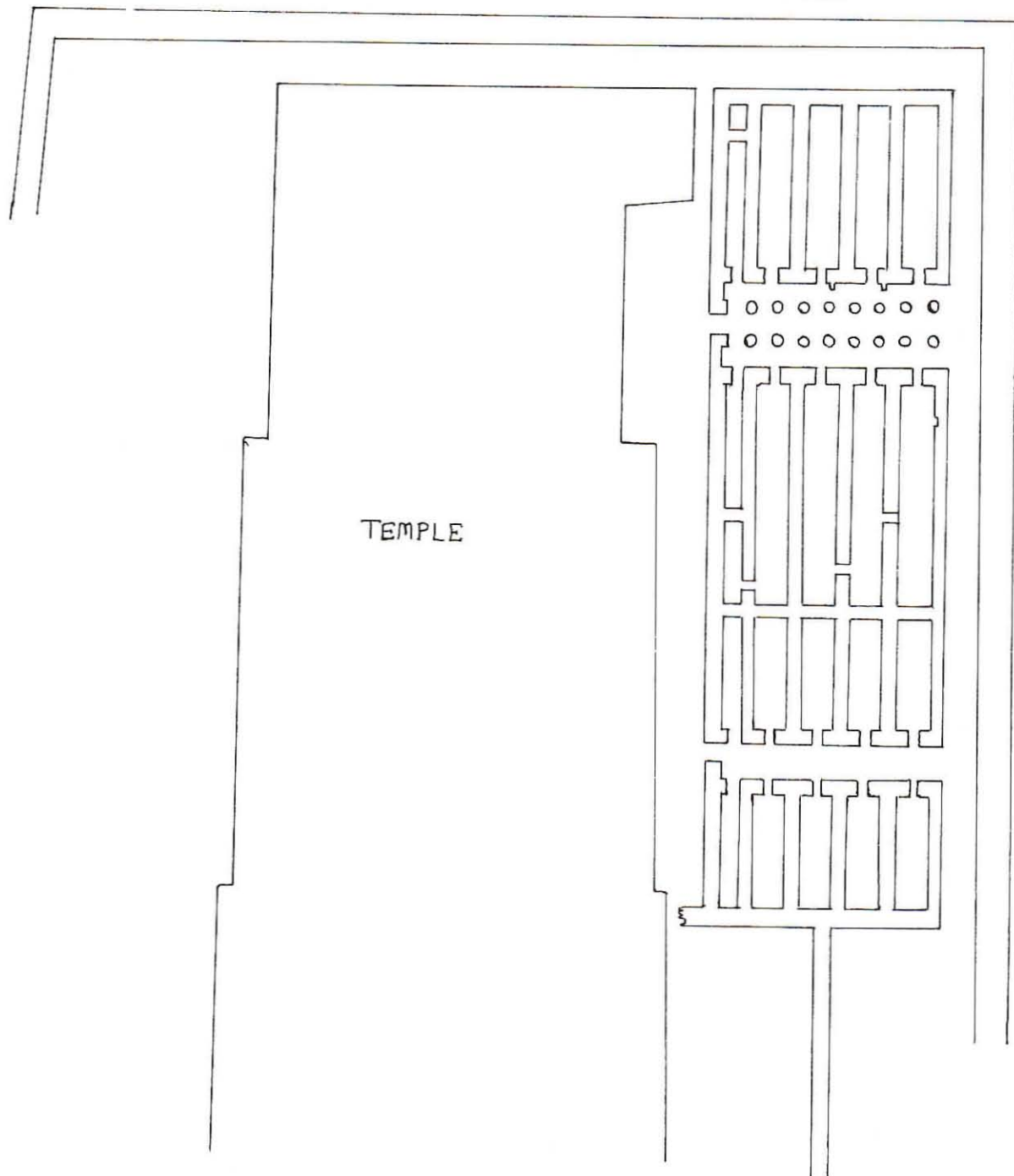
BRICK SIZES



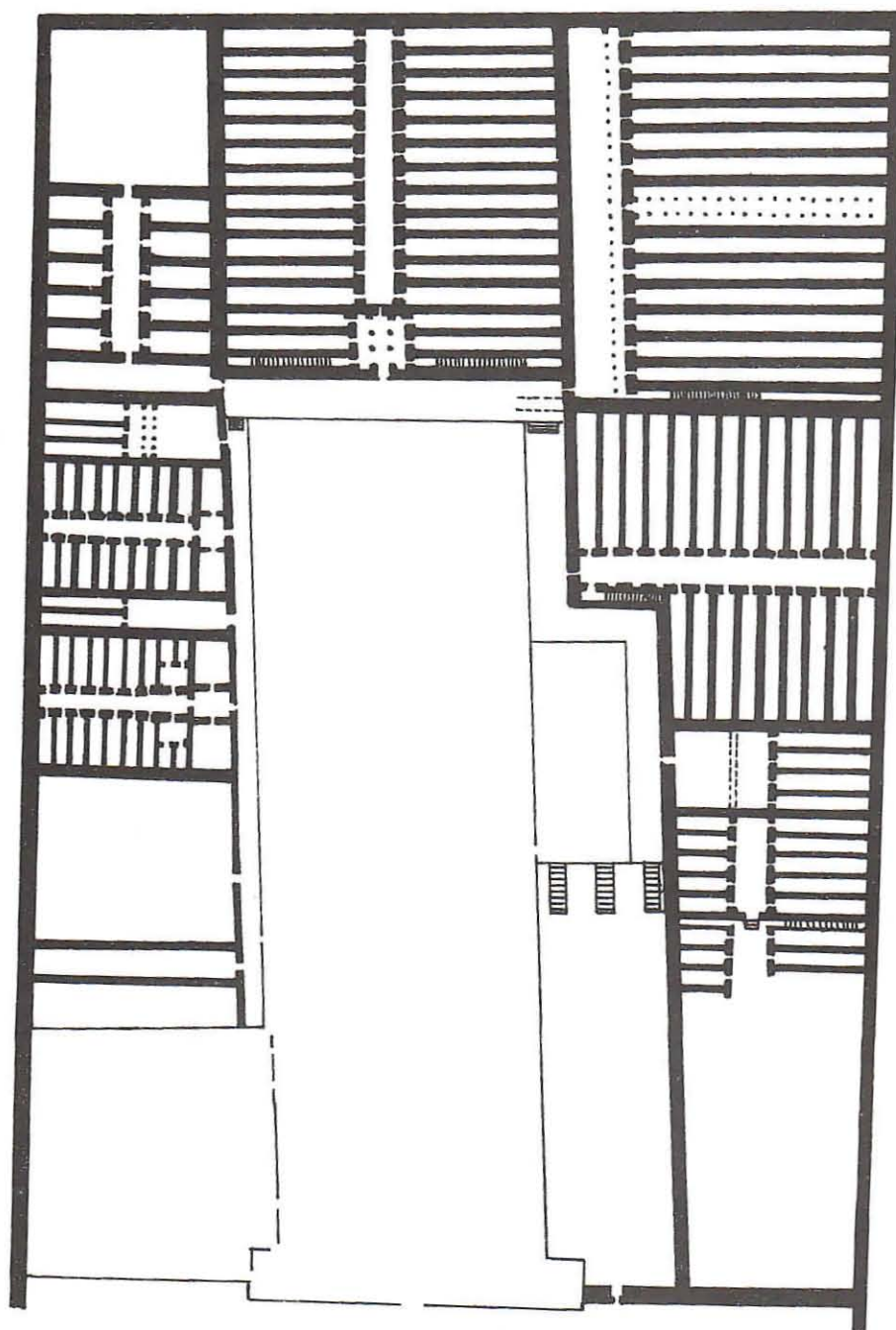
BRICK SIZES



STOREHOUSES OF THE MORTUARY TEMPLE OF MERENPTAH



STOREHOUSES AT THE RAMESSEUM





Pl. 49 A (Top): Karnak Enclosure Wall, North side, inner face.

Pl. 49 B (Centre left): Air channel in Karnak enclosure wall.

Pl. 50 A (Centre right): Wall of the XXVth dynasty, Karnak.

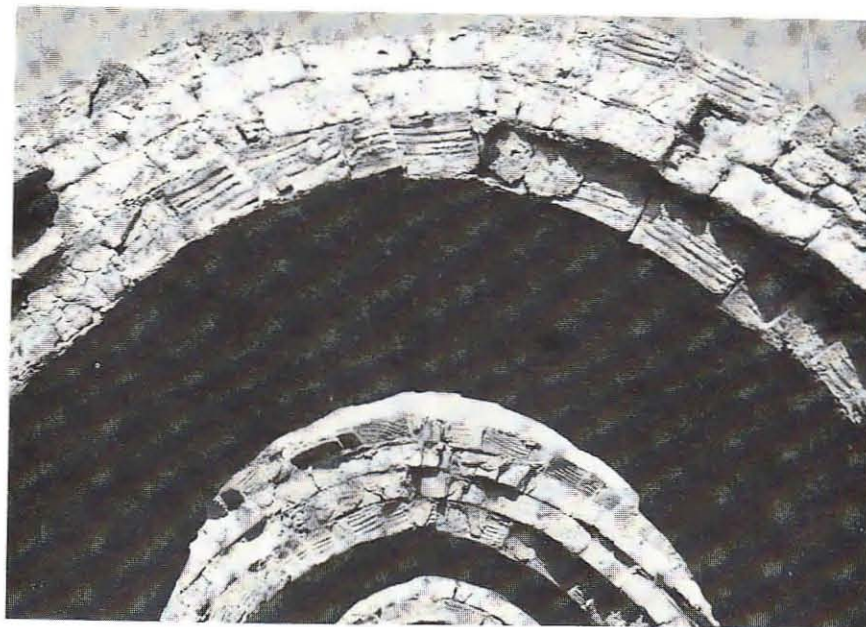
Pl. 50 B (Bottom): Wall at the temple of Amun-Hearer-of-Prayers, Karnak.



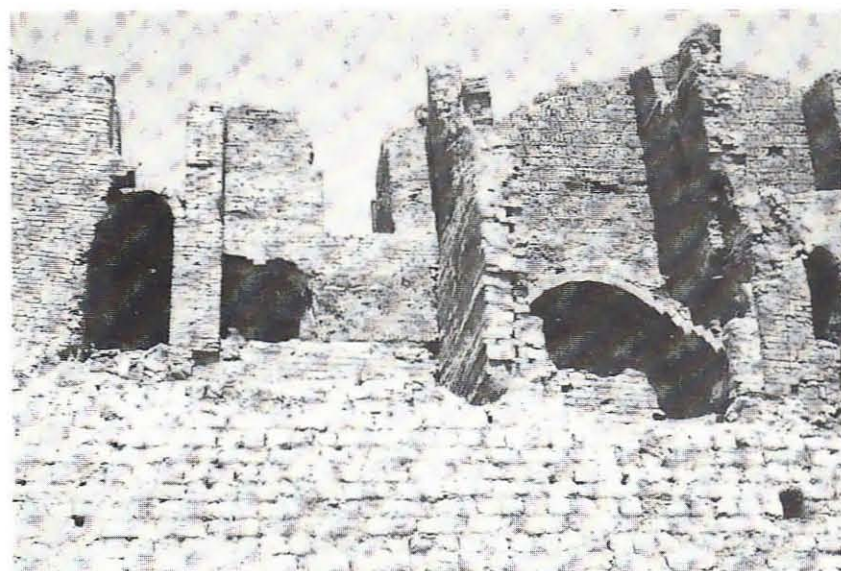
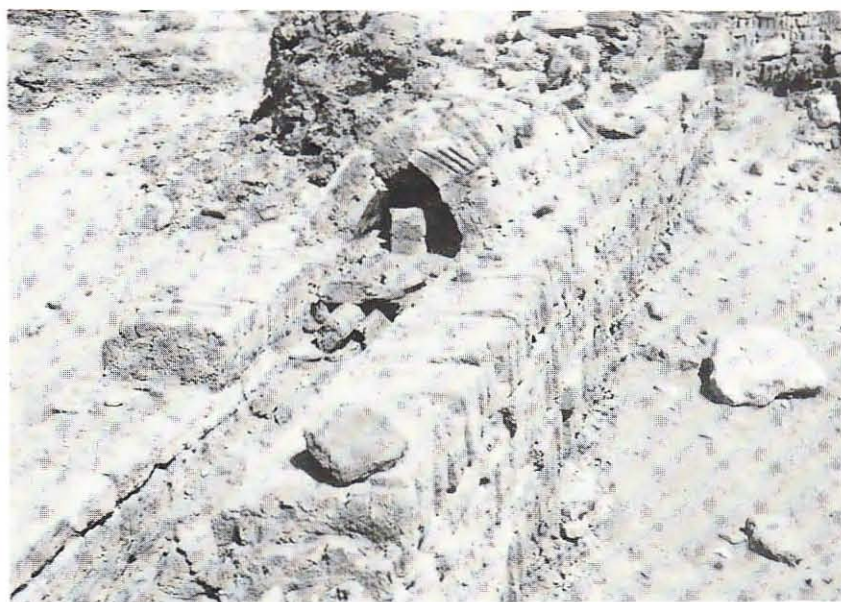
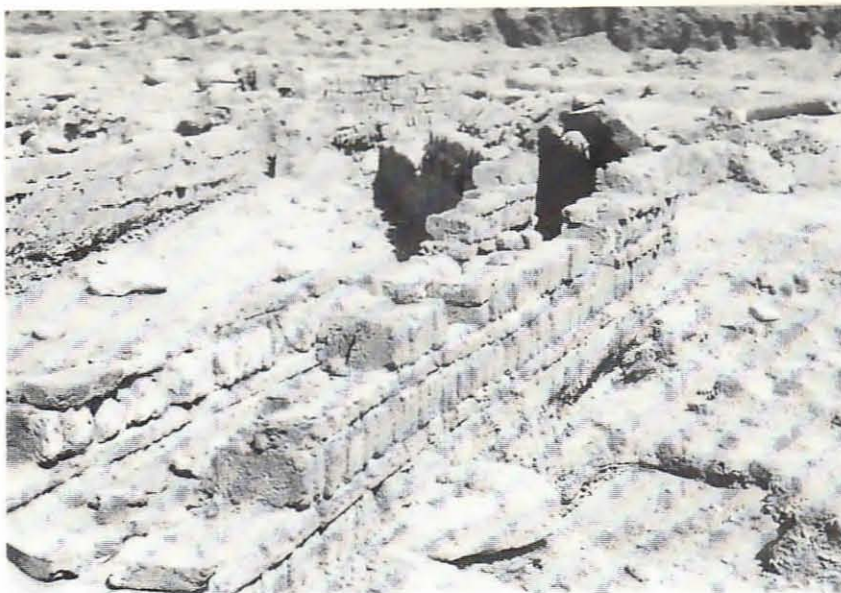
Pl. 51 A (Top): Dendera enclosure wall.

Pl. 51 B (Middle): Deir El-Medina Temple wall.

Pl. 52 A (Bottom): Vault over Mammisi, Deir El-Medina.



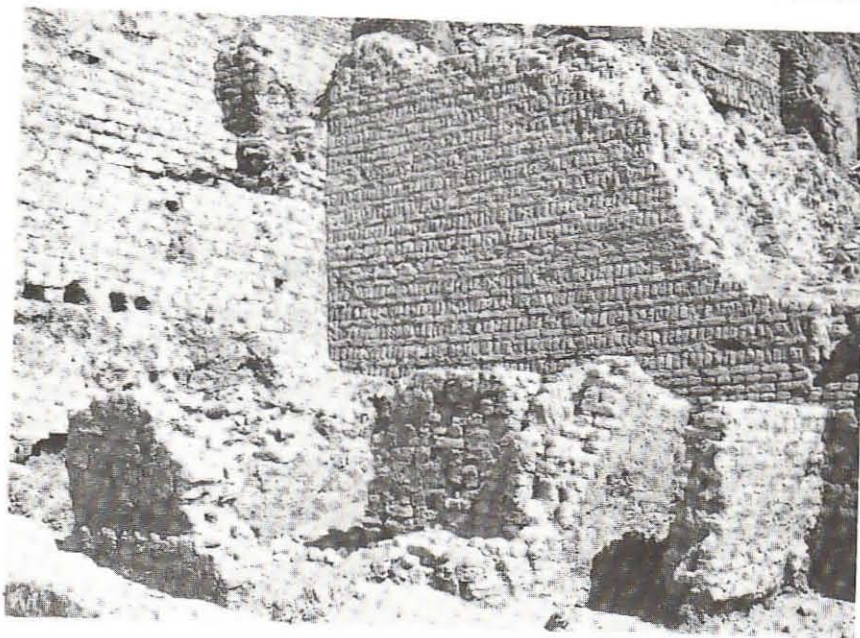
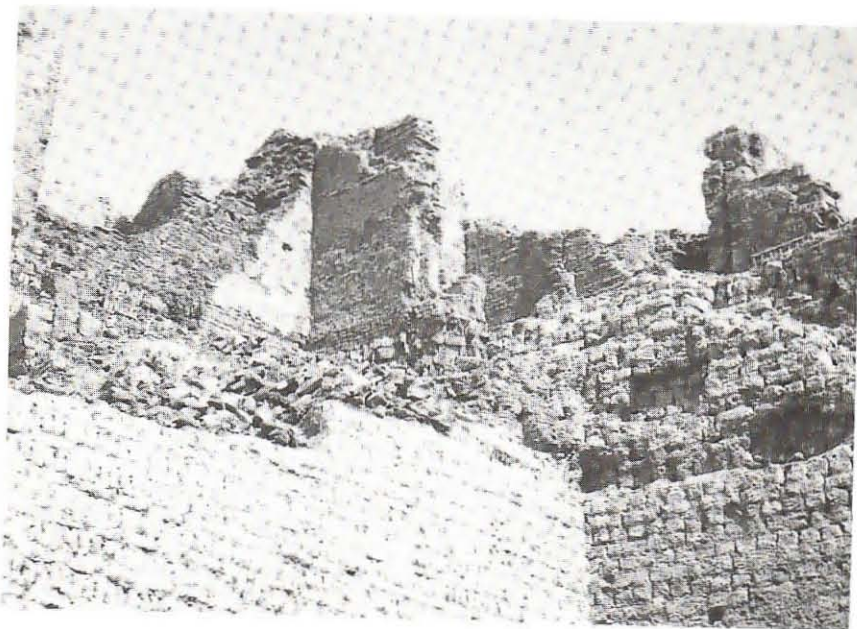
Pl. 52 B (Top): Ramesseum storehouses.
 Pl. 53 A (Middle): Springing of Vaults, Ramesseum.
 Pl. 53 B (Bottom): Details of vaults, Ramesseum.



Pl. 54 A (Top): Conduit A at Medinet Habu.

Pl. 54 B (Middle): Conduit B at Medinet Habu.

Pl. 55 A (Bottom): Coptic houses, Medinet Habu.



Pl. 55 B (Top): Coptic house, Medinet Habu.

Pl. 56 A (Middle): Coptic buildings above Roman tower, Medinet Habu.

Pl. 56 B (Bottom): Roman tower, north-west corner of temple enclosure, Medinet Habu.